Partnerships

Table of Contents

Partnerships

This chapter opens with an overview of COSEE partnerships at the National Network level. This is followed by descriptions of the many partnerships established by the COSEE Centers.

National COSEE Network Partnerships

The National COSEE Network (NCN) is built upon a foundation of partnerships. To apply for NSF funding, each Center must be comprised of partnerships between at least one ocean science research institution and formal and informal science education institutions. The Centers have many more than the three required partners with the fourteen current Centers bringing close to 270 institutional partners into the COSEE Network. This includes 113 universities and research institutions and more than 80 aquariums and science centers. The remaining partners are some of the largest school districts in the country, such as the Los Angeles Unified School District, community colleges, and local, state and federal agencies. The NCN has developed into the nation's most comprehensive ocean science and education network, and the list of Center and Network partners is extensive and growing.

In addition to the internal Network partnerships developed by the Centers, the COSEE National Office (NCO) has been developing external partnerships with national societies and other ocean science research and education networks. In 2010, the NCO brought a Partnerships and Collaborations Coordinator on board to focus on develop new mutually beneficial partnerships and expanding existing partnerships. The National Advisory Committee has advised COSEE to develop such partnerships as a means to grow, leverage resources, and build sustainability. Thus, partnership-building activities are embedded into COSEE's Annual Operating Plans.

Several Centers have also been successful at establishing external partnerships with other networks to support their activities. COSEE Central Gulf of Mexico has partnered with the Gulf of Mexico Alliance. The content that their scientists deliver each year is related to the Alliance's priority issue themes. The Center uses the Alliance for scientist recruitment and helping to determine the ocean science important in their region. COSEE Alaska has a similar relationship with the North Pacific Research Board. Over half of the Centers have formal relationships with their regional Coastal Ocean Observing Network, and most Centers have a formal partnership with their local Sea Grant offices.

The NCO is creating relationships with several programs and professional societies to strengthen the reach of the COSEE Network. A memorandum of understanding was signed by COSEE and the American Meteorological Society in 2011. Discussions are underway to conduct the first joint programming in fall 2011 - a national webinar series on hurricane science and the role of the ocean with several U.S. hurricane scientists.

COSEE has also embarked on an exciting collaboration with the new U.S. Inner Space Center and the NOAA Office of Ocean Exploration and Research (OER). This partnership is allowing for a proof of concept project through which new hardware and software are being developed to allow live and pre-programmed audio, video, and data feeds from research vessels at sea to reach two COSEE partner aquariums, South Carolina Aquarium and Mystic Aquarium. Professional development for aquarium staff is including ocean sciences content instruction and technology training. Stage two will be to expand the ability to receive these feeds to other Network member informal science education institutions. This cutting edge initiative has been made possible because of the combined expertise of the Inner Space Center, NOAA OER, and the NCN.

A significant partnership has been established with the Smithsonian Institution (SI) National Museum of Natural History (NMNH) and it's Sant Ocean Hall (SOH). The SOH opened in 2008, and is one of the largest exhibits at the museum, providing 23,000 square feet of visitor space focusing on the latest in ocean sciences information and technologies; it presents the ocean as an integrated system with scientific research stories woven throughout. The SOH was based on the Ocean Literacy Essential Principles and Fundamental Concepts, the development of which was led by educators and scientists involved in the COSEE Network. In 2009, a partnership agreement was developed that created a new position at the NMNH, the COSEE Ocean Hall Educator. With 50% percent of the funding provided by both the Smithsonian and NOAA, the COSEE Ocean Hall Educator creates public programs related to ocean sciences for the NMNH.

The NCN has been instrumental in providing resources and guidance to the NMNH Educator, who is an official member of the NCN. With COSEE's assistance, the NMNH was successful in obtaining NSF funding to conduct a two year ocean sciences lecture series in the NMNH's Baird Auditorium. These highly successful ocean themed public lectures are also streamed live over the Internet. The NCN has been instrumental in identifying key ocean sciences topics and recruiting the speakers for the lecture series. In addition, each speaker spends a half-day in the Ocean Hall for the "Scientist Is In" program. This partnership provides the NCN a national presence in the Washington DC area and a physical venue through which to broadly reach the American public, as over 7 million people visit the NMNH in person each year and another 25 million visit through the web.

A key ingredient in building partnerships is visibility in the ocean sciences research and education communities as well as in the broader STEM communities. In an effort to increase the visibility of COSEE within target audiences, an organized COSEE presence at various national science and education society conferences and meetings has been underway. In addition to the usual sessions and exhibit booth, COSEE has developed or is in the process of developing partnerships with several national societies. The NCN has established a memorandum of understanding with the American Association of Limnology and Oceanography (ASLO) and has partnered with the ALSO Multicultural Program to conduct workshops for young investigators. COSEE will embark on future collaborations with the ASLO Multicultural Program to offer other opportunities for these undeserved students.

COSEE has partnered with The Oceanography Society (TOS) to produce, publish, and disseminate a collection of physical oceanography activities at the high school and undergraduate

level. Discussions are underway with TOS and the American Geophysical Union to develop similar resources for geological, chemical, and biological oceanography. In addition, COSEE is collaborating with the Marine Technology Society to provide professional development opportunities for educators at their annual meetings.

The NCN has established a significant presence at the National Science Teachers Association (NSTA) Annual Convention, which attract close to 20,000 science teachers each year. Over the last four years, COSEE has grown from occupying a small booth in the exhibit hall to an island booth with strategic placement on the floor, and as a result, visibility has greatly increased. The number of people stopping by the booth has increased from 200 to over 700 teachers. In addition, by collaborating with NSTA, the COSEE presence has grown from offering two sessions to offering an entire day of COSEE programming that is highlighted prominently in the program. In addition, COSEE sponsors a luncheon that annually features a nationally recognized ocean scientist as the speaker.

COSEE is working with the Society for the Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) to increase the visibility of ocean sciences at their annual meetings. COSEE, in partnership with SACNAS ocean scientist members, sponsors annual ocean sciences symposia and panels focused on the ocean sciences as well as workforce opportunities. This has provided a valuable experience for underrepresented undergraduate students who have not been exposed to the ocean sciences enterprise and its breadth of career opportunities. Participation in these programs has grown from approximately one dozen students in year one (2008) to over 85 students in 2010.

Without the existence of the National COSEE Network, most of these partnership activities would not take place. By leveraging relationships with its partners, COSEE has been able to reach far beyond the circle of influence that a collection of individual Centers might have. The Network has become nationally recognized as the “go to” organization for ocean sciences broader impact activities, as proven by the diversity and scope of its partnerships.

Partnerships of the COSEE Centers

COSEE California

Section 1: Projects Involving Significant Partnerships

Communicating Ocean Sciences Network

The Communicating Ocean Sciences (COS) Network is a community of ocean scientists and educators, and their institutions that teach the Communicating Ocean Sciences K-12 and/or the *Communicating Ocean Sciences to Informal Audiences* (COSIA) college course, as well as several other derivative programs, that all were developed by COSEE California. The Network comprises research scientists from colleges and universities around the country who co-teach at least one of the courses, usually with an educator from an informal science education institution (ISEIs).

COSEE California received two grants for the COS Network from NSF Informal Science Education, one for $1.8 million to establish partnerships and develop the COSIA course, and the second for $2.87 million to create new knowledge about how to: broaden participation and more effectively communicate ocean and climate sciences content to underrepresented audiences and those in landlocked areas; create opportunities for networks of educators and scientists to work together effectively; develop a cross-disciplinary distributed network as a strategic mechanism to support and build the capacity of scientists in institutions of higher education (IHEs) and educators in ISEIs to: (1) work together as a collaborative community and (2) use shared materials (college course, professional development for informal science educators, scientists, and afterschool educators) as concrete tools around which individuals and organizations can do meaningful work together at ISEIs.

The NSF ISE-supported partnerships within the Network include:

- Hampton University and Virginia Aquarium;
- Scripps Institution of Oceanography and Birch Aquarium;
- University of Southern California and Aquarium of the Pacific;
- Oregon State University and Hatfield Marine Science Center;
- Rutgers University and Liberty Science Center;
- Purdue University and 4-H agents; and
- University of California at Berkeley and Lawrence Hall of Science.

In addition, the following additional partners are working closely with COSEE California to implement and/or disseminate the courses:

- University of Washington,
- University of Oregon,
- California State University (CSU) Humboldt,
- California State University, Cal Poly,
- California State University, Sonoma,

- University of Hawaii, Maui College,
- University of Hawaii–Manoa,
- Western Washington University,
- George Mason University and Smithsonian Institution,
- Old Dominion University and Virginia Aquarium,
- Virginia Institute of Marine Sciences (College of William and Mary),
- Woods Hole Oceanographic Institution,
- Stanford University,
- University of California, Santa Cruz,
- University of California, Santa Barbara,
- University of Michigan,
- University of Alaska, Fairbanks,
- University of Alaska, Anchorage,
- University of Alaska, Southeast,
- University of San Diego,
- Tokyo University of Marine Science and Technology, Japan,
- Yokohama National University, Japan,
- Coastal Carolina University (2011),
- University of South Florida (2011)

Pacific Ocean Literacy for Youth, Publics, Professionals and Scientists
Pacific Ocean Literacy for Youth, Publics, Professionals and Scientists or "POLYPPS" is a collaboration between University of Hawaii at Manoa, Maui College, and COSEE California. The partnership specifically is designed to extend the COSEE California Communicating Ocean Sciences courses (COS K-12 and COSIA) to the Central Pacific Region. The long-range goal is to build a collaborative network that connects ocean research and teaching with traditional knowledge to facilitate active engagement in stewardship and policy by all ocean users. This partnership was funded by an NSF OCE COSEE New Collaboration with an Existing Center grant.

POLYPPS Collaboration with OCEANIA Marine Educators Association
POLYPPS has been working with the OCEANIA, the Hawaii/Pacific Island chapter of NMEA, to jointly develop and offer professional development field trip opportunities for informal educators and teachers. These research focused field trips are held in conjunction with the COSIA training workshops hosted by POLYPPS, and are co-coordinated by POLYPPS and OCEANIA staff. The collaboration allows both organizations to offer value-added professional development to educators who are already coming together for a defined purpose. They enhance the COSIA experience, and allow OCEANIA to reach potential new members.

POLYPPS Partnership with UH Sea Grant
POLYPPS and Sea Grant enjoy a close working relationship, with two of the POLYPPS team also on the Sea Grant staff. This has allowed us to jointly develop and disseminate resources, such as the online videos of COSIA training workshops that are hosted on the Sea Grant website.

Reflecting on Practice
Reflecting on Practice is a whole-department professional development program for informal science educators in museums, aquariums and science centers to discuss and learn about research on learning and teaching, and reflect on their practice. The program is based on materials from the *Communicating Ocean Sciences* college courses, and is informed by current research on teaching science in informal environments. COSEE California received a $318,000 grant from the Institute for Museum and Library Services (IMLS) to field test the program at five informal science education institutions. These sites include: the Huntington Library, Art Collections, and Botanical Gardens; Imagination Station Science Museum; Brookfield Zoo; Oregon Museum of Science and Industry; and Explorit Science Center. COSEE California hosted a Reflecting on Practice Instructors Workshop in December 2009. Teams from each of the partner sites listed above attended the Workshop and subsequently have taught the Reflecting on Practice professional development program to their respective staffs.

Ocean Literacy Campaign
The Ocean Literacy Campaign is a wide-ranging, collaborative and de-centralized effort by scientists and educators to create a more ocean literate society. COSEE California has taken a leadership role developing the two foundational documents of the Campaign— *Ocean Literacy: The Essential Principles of Ocean Sciences K-12* and *Ocean Literacy Scope and Sequence for Grades K-12*. COSEE California coordinated extensive discussions, meetings, and reviews for scientists and educators to work together to create these consensus documents. Partnerships with scientists and educators from private, public, and government organizations include:

- National Marine Educators Association,
- K-12 Alliance/WestEd,
- NOAA Office of Education,
- NOAA Sea Grant (several states and the National Sea Grant Office),
- NOAA Office of Exploration & Research,
- National Geographic Society,
- Monterey Bay Aquarium,
- Monterey Bay Aquarium Research Institute,
- Every existing COSEE center (see Cross-Center Activities),
- numerous universities around the country.

San Diego Unified School District (SDUSD)
Working with district administrators, COSEE CA staff established a partnership with SDUSD through its Educational Technology Department (Ed Tech), specifically working together in the District's "No Child Left Behind" program, *Enhancing Science Education through Technology* (ESETT). This partnership served as the basis for the 21st Century Classroom initiative in the 2007 COSEE CA proposal. Shortly after the 2007 COSEE CA proposal was submitted two important events occurred. First, Scripps solidified their SDUSD collaboration with an MOU to collaborate on ES education in district high schools and second, ES was adopted as a district wide program. These events and this partnership represent the culmination of COSEE CA activities in the preceding 5 years during which time COSEE CA staff worked to cultivate administrators and educators within the district to promote earth and ocean sciences education and strong links between district educators and Scripps researchers.

Educational Technology Department and the Enhancing Science Education Through Technology Program

At the middle school level we work with the Ed Tech Department and their *Enhancing Science Education Through Technology (ESETT)* program to leverage their work in bringing technology into science instruction and to promote science and technology literacy. The ESETT program prepares and supports teachers as they enhance science content with the use of educational technology including computers, presentation systems, electronic learning resources, and software applications. This technology facilitates student interaction with data, and more recently research scientists, in ways that allow student-directed learning and collaborative knowledge building. COSEE California collaborates with SDUSD EdTech to: provide the technology-based tools and web-based resources that engage students in science activities based on state and national science content standards and ocean literacy principles; and to provide a research-based professional development for science teachers.

High School Earth Sciences Program

At the high school level we work primarily with teachers teaching in the recently (3 years) adopted SDUSD Earth science program. Content-based professional development, involving researchers and their graduate students, and supported through researchers' broader impact components (budgets include stipends for teachers and funding for materials and supplies) are emerging as an effective vehicle for conveying current ocean sciences research to local teachers. The Scripps GK12 program, a direct outgrowth of COSEE CA activities, is linking teachers and Scripps graduate students together to bring leading edge research into SDUSD classrooms and to create an enduring legacy of online, standards-based teaching modules for Earth, ocean and environmental sciences. The *Scripps Classroom Connection*, a Scripps GK12 program, leveraged the COSEE CA relationship to extend and expand the Scripps/SDUSD partnership. Through SCC, 9 graduate fellows per year spend ~10 hours per week in local area classrooms, bringing Scripps research into earth, ocean, biology and environmental science classrooms.

Ocean Observatories Initiative (OOI) – Cyberinfrastructure Implementing Organization (CI IO)

COSEE CA played a major role in creating the education plan for the OOI Cyberinfrastructure implementing organization and was on the team that created the education plan for the OOI Coastal Global Regional Scale Nodes part of the program.

While the initial focus of OOI CI outreach is necessarily to higher-level user audiences, a portion of the E&O effort is focused on providing opportunities for the public and pre-college students to learn about the OOI. Central to this objective is collaborating with the OOI CI to develop, prototype, and formatively evaluate "serious games" that use traditional video gaming platforms (e.g. XBOX 360) to teach about the deep-ocean, ocean research and ocean observatories. The games can be used in both formal and informal settings, but the current formative evaluation effort is focused on the informal environment. Serious gaming is a burgeoning field of education, but to date the focus has been on 2-D games that are designed for long-term play. The OOI CI/COSEE CA game (Deep sea Extreme Environment Pilot) is built on an Xbox platform

using open source software. Advantages of using this popular gaming technology include the ability to support the games on any XBOX 360 console or Windows-based desktop machine, as well as the use of standard XBOX gaming controls already familiar to a large number of middle and high school students. These games can potentially serve as integral components of problem-based learning activities, and be structured to promote higher-order thinking skills in an entertaining context. Games for mobile devices are also under development.

Looking to the future, and recognizing the need for a multidisciplinary team to provide access to OOI data and other resources for non-scientists, COSEE CA and the OOI CI have recently collaborated with the Education Development Center in Newton MA and have received funding to conduct a review of the learning sciences research base for how high school students learn with large data sets, and what interface design principles need to be embraced when creating access portals for student audiences.

Education Development Center (EDC), Learning and Teaching Division, Newton MA
The Learning and Teaching Division at EDC is a recognized leader in the design of formal and informal learning environments for children, youth, adults, and educators. Through a DR K12 award, COSEE CA and the OOI CI are working with senior scientists at EDC to conduct a review of literature and expert opinion to consolidate knowledge that will inform efforts to use scientific cyberinfrastructure in high school classrooms. The overarching question being addressed is:
In what ways can learning research inform the development of electronic interfaces and tools for use by students accessing large scientific databases?

The knowledge gained will be used to specifically inform the education and public engagement component of the NSF's Ocean Observatories Initiative (OOI), which is developing an integrating cyberinfrastructure for collecting data (from coastal to deep ocean environments), distributing data to scientists in near real-time and providing interactivity with ocean instruments and sensors.

The task of bringing state of the art knowledge to bear on the work of cyberinfrastructure-enabled projects and intermediary developers is not straight forward because relevant expertise is widely dispersed across disciplines and spans a number of topics. In the education field, for example, work has been done regarding classroom use of large data sets, visualization; statistical reasoning and graphical analysis, and scientific reasoning with evidence. Further, there is an emerging body of salient work in such fields as visual analytics, smart graphics, and augmented cognition that could inform education efforts. Although collectively, such studies, and the experts who have performed them, could offer a rich body of knowledge, there is no "big picture" synthesis to guide interface and tool development for pre-college students. The project will therefore produce a status report that consolidates findings from the literature, suggests areas of needed research, and presents design recommendations.

The findings will also have broad application to: 1) other science observatory cyberinfrastructure projects in disciplines such as biology, astronomy and geophysics that are concerned with having a "broader impact" on pre-college students; and 2) intermediary developers, such as R&D

organizations, publishers, and software development companies that will be creating interfaces/tools that could make data accessible to, and usable by, high school students.

UCSD-TV

We are also working closely with UCSD-TV to disseminate ocean science research through the Perspectives on Ocean Science speaker series (http://www.ucsd.tv/oceanscience/). Increasingly the Internet is proving to be an effective medium for providing unprecedented numbers of people with access leading edge ocean science content. The broadcast audience for UCSD-TV is over 15 million, but an emerging powerhouse audience is the online viewer. The POS series is emerging as the most frequently downloaded content from the UCSD-TV website, the series as a whole exceeding 3 million downloads of the recorded presentations in Fall 2010. POS is a popular broader impact option for Scripps scientists.

Section 2: Notable Partners

Institute of Marine and Coastal Sciences, Rutgers University

The Institute of Marine and Coastal Sciences (IMCS) is a world-class oceanographic research institute at Rutgers University that is dedicated to discovering and communicating exciting and critical science about our planet for the benefit of society. COSEE California has partnered with scientists and educators at IMCS on numerous grants and projects to connect scientists and educators and to promote ocean literacy. These projects include: the *Ocean Sciences Curriculum Sequence for Grades 3-5*; *Ocean Science Curriculum Sequence for Grades 6-8*; first implementers of the Communicating Ocean Sciences K-12 college course; co-developers of Communicating Ocean Sciences to Informal Audiences college course; co-developers of COSIA Scientist Workshops; and the Ocean Literacy Campaign (contributors to: the Ocean Literacy Scope and Sequence for Grades K-12).

Lionel Wilson College Preparatory Academy

Lionel Wilson College Preparatory Academy is a grade 6-12 school that is part of the Aspire Public Schools charter, and is a partner on the COSEE California NSF OEDG-funded ¡Youth and the Ocean! (¡YO!) project. The school's student body is comprised of 80% Latino and 20% African American students, two groups which are currently underrepresented in ocean sciences careers. During this project, several ocean scientists have given their time to work with middle and high school students and teachers participating in the project, including Skyping with summer school classes about their research organisms and mentoring students through independent research projects, and providing tours of their laboratories during week-long residential research camp each spring at the University of California Bodega Marine Lab. During the ¡YO! project period, Lionel Wilson hosted three summer science and reading academies, which each included a week-long professional development institute and a month of teaching practicum with summer school students at Lionel Wilson's summer school. The professional development during this academy leveraged the COSEE-funded Communicating Ocean Sciences course by modifying several course sessions for use with the teacher participants. The practicum

used the Ocean Literacy Scope & Sequence-based *Ocean Sciences Curriculum Sequence for Grades 3-5* as curriculum for some of the summer school students.

Carolina Biological
Carolina Biological is a leading provider of biological supplies and science teaching materials worldwide. Carolina Biological is an investor in, and will publish and distribute, the NOAA-funded *Ocean Sciences Curriculum Sequence for Grades 3-5* and *Ocean Sciences Curriculum Sequence for Grades 6-8* that COSEE California is developing in collaboration with GEMS (Great Exploration in Math and Science), COSEE NOW, and NOAA scientists.

Bodega Marine Laboratory, University of California, Davis
The Bodega Marine Laboratory (BML) of the University of California, Davis is one of the oldest academic marine laboratories in the U.S. BML has hosted a residential marine science research camp as part of COSEE California's ¡YO! project (see Lionel Wilson College Preparatory Academy) for three years. As host, they provide our ¡YO! middle school participants with housing, laboratory space, wetlab materials, computer facilities, running seawater, a library, and a librarian so that students can pursue their own research interests. Laboratory scientists, including graduate students, also engage with ¡YO! participants while they are on site, offering lectures about their own research topics and stories of how they became scientists as well as mentoring students through their research projects. Several scientists at the lab also come to student presentations so that the students can share their research findings with real scientists. This partnership has been invaluable to the project, as pairing scientists with aspiring scientists, especially those from underrepresented audiences, helps students to envision a career as a scientist and a pathway to getting there.

University of California, Santa Cruz
The Institute of Marine Sciences (IMS) is an organized research unit at the University of California, Santa Cruz. With funds from an NSF GeoEd grant, COSEE California partners with ocean sciences graduate students from IMS to work with and mentor high school students from Oakland, California on their ocean sciences research projects. Training for the graduate student mentors will leverage several sessions of the COSEE-funded Communicating Ocean Sciences course, and will be taught by a UCSC scientist who instructs the course during the school year.

Romberg Tiburon Center for Environmental Studies, San Francisco State University
The Romberg Tiburon Center for Environmental Studies is San Francisco State University's marine laboratory. Their mission is to advance understanding of the world's complex marine and estuarine environments through research, education, and outreach, with a focus on San Francisco Bay. COSEE California partners with the Romberg Tiburon Center through a California Coastal Commission Whale Tail Grant. The partnership involves research scientists from Romberg working with educators at LHS to introduce underserved students from Oakland to scientists and their investigations of local coastal habitats, organisms, and restoration projects.

Joint Institute for Marine Observations (JIMO)
The Joint Institute for Marine Observations is one of eleven Joint Institutes within the National Oceanic and Atmospheric Administration (NOAA), Oceanic & Atmospheric Research (OAR)

office. COSEE California worked with JIMO researchers to prepare education and outreach components for their research proposals and engage in outreach activities. COSEE CA staff member Eric Simms worked with JIMO as an E&O coordinator for 2 years.

Junior High School 014 Shell Bank
Junior High School 014 Shell Bank is a new oceanography magnet school for junior high students in Brooklyn, NY. COSEE California supported the school and teachers as they designed and introduced the new oceanography curriculum with science and literacy integration. The school used the MARE curriculum, which was designed by Lawrence Hall of Science, to inform development of their curriculum. Teachers came to LHS to do professional development, and COSEE California staff from LHS coached teachers on science and literacy at their school site. This partnership contributes to COSEE California's efforts to promote ocean literacy, and specifically informs the development of the Ocean Sciences Curriculum Sequence Grades 6-8.

SMILE Pathway
Science and Math Informal Learning Educators Pathway (SMILE) is an informal educators' portal of the National Science Digital Library (NSDL; http://www.howtosmile.org/) that is built in collaboration between the Exploratorium, Lawrence Hall of Science, New York Hall of Science, Science Museum of Minnesota, Children's Museum of Houston, ASTC and NSDL. SMILE is collecting the best educational materials on the web and creating learning activities, tools, and services – all designed especially for those who teach school-aged kids in non-classroom settings. COSEE California partners with the SMILE Pathway to include exemplary activities developed by informal educators co-teaching the COSIA course in the Pathway (search "oceans" at http:///howtosmile.org). The presence of these activities on the SMILE Pathway provides a mechanism for considerable dissemination to many more informal science education institutions and educators nationwide.

Vista Unified School District and National City Unified School District, California
Schools from Vista USD and National City USD worked with the COSEE California MARE Center from 2002-2007 to implement a school wide, interdisciplinary ocean sciences program that utilized the expertise of scientists and graduate students at Scripps Institution of Oceanography. During a time of significant economic hardship, budget cuts and extreme accountability around language arts and mathematics, these schools devoted large amounts of instructional time to their immersion into ocean sciences. Among many outcomes, the schools documented significant increases in the amount of parent involvement in the academic life of the schools.

Scripps Community Outreach and Public Education (SCOPE)
Scripps Community Outreach and Public Education is an organization of graduate students, faculty and staff at SIO who have come together to identify, as well as create, E&O opportunities for SCOPE members. COSEE California has been the focus of some SCOPE meetings to identify outreach activities of interest to SCOPE members. Additionally, SCOPE members and COSEE California worked together to create and pilot a Scripps-based field trip called *Discover*

Oceanography, an activity designed for 30-45 middle or high school students. Over 100 students have participated in the field trip.

RIDGE 2000
Ridge 2000 is an interdisciplinary initiative to study Earth's oceanic spreading ridge system as an integrated whole, from its inception in the mantle to its manifestations in the biosphere and water column. COSEE California facilitated SIO graduate students participation in RIDGE-2000 activities. These included SIO graduate students presenting in a RIDGE 2000-sponsored teacher-workshop in 2006 at the Ocean Institute in Dana Point, and graduate students volunteering as reviewers of student-generated reports produced in Ridge 2000's SEAS (Student Experiments at Sea) Program (http://ridge2000.bio.psu.edu/SEAS/seas.php).

COSEE was also instrumental in creating the Education and Outreach section of the Scripps proposal for the Ridge200 Office in 2005. The successful proposal included funding for a part time Communications/E&O coordinator (Simms), an exhibit element at the Birch Aquarium at Scripps (the XBOX 360 DEEP game) and resources and support for hosting the "RIDGE2000-themed" MATE ROV competition at UCSD.

The Southern California Coastal Ocean Observing System (SCCOOS)
Early in the history of SCCOOS history, COSEE CA coordinated the education and outreach partnerships for the network. For example, through a COSEE CA facilitated partnership between SCCOOS and the Ocean Institute in Dana Point, an investment in a pilot education and outreach program has been leveraged into a curriculum "Weather and Water" that has been disseminated county-wide, reaching 5th graders in 100 classrooms in 17 districts.

COSEE CA continues to partner with SCCOOS, with the current collaboration including building data interfaces for use in science centers and finding ways to use SCCOOS data and resources in classrooms.

Scripps Classroom Connection (GK12)
The Scripps Classroom Connection (SCC) is a direct outgrowth of the COSEE CA partnership with San Diego Unified School District. SCC aims to systemically and simultaneously improve communication skills of Earth science (ES) graduate students and K-12 Earth sciences education at the San Diego Unified School District (SDUSD). The SCC is based on a close collaboration between Scripps Institution of Oceanography, a world-class research institute in Earth and ocean science, and the SDUSD, the 8th largest urban school district in the US, with the guidance of professionals from the UCSD education science department.

Ocean Institute
The Ocean Institute is a private, non-profit, informal science center that uses innovative, marine science and history-focused programming and exhibits to address CA state content standards in science, history, math and literacy. The COSEE CA partnership with the Ocean Institute in Dana Point has provided one of the most productive outlets for researcher involvement in education and outreach to date. From the substantial and ongoing collaboration with the California Current Ecosystem Long Term Ecological Research site that engages students in field measurements that

contribute to the CCE LTER research program, to the exhibit components created based on researchers' science (e.g. Fire and Ice display and workshops on methane hydrates; the mock up of a Scripps marine sediments lab; the ocean bottom seismometer display that incorporated activities in understand seismicity and plate tectonics).

Office of Student Educational Advancement
Through a COSEE initiated partnership with the UCSD Office of Student Educational Advancement (TRIO program), Scripps Community Outreach and Public Education (SCOPE) participated for 3 years in a program for 100+ middle and high school students from underserved schools in southern San Diego county. Students tour SIO labs, deploy plankton nets from the SIO pier and learn about SIO biological oceanography research from SIO graduate students. The TRIO program is designed to increase the diversity of the student population at UCSD. The COSEE CA TRIO served as the catalyst and model for continued SCOPE outreach activities to school age children.

Aquatic Adventures Science Education Foundation (now Ocean Discovery Institute)
COSEE CA, Scripps scientists, Birch Aquarium staff and the Aquatic Adventures Science Education Foundation have combined their respective expertise to create a hands-on field trip experience for 6th graders. *Visualization in Earth and Ocean Sciences* reaches nearly 2000 students each year from some of San Diego's most underserved and diverse schools.

COSEE CA has also supported researcher participation in AASEF programs through facilitating researcher inclusion of AASEF activities as a means of fulfilling NSF and other funding agency Broader Impact opportunities. Many of the relationships forged by COSEE CA continue today without COSEE CA involvement, fulfilling the overarching goal of catalyzing sustainable scientist educator partnerships.

COSMOS
COSEE CA initiated and facilitated Scripps participation in the California Science and Mathematics Summer Program (COSMOS) at UCSD. Funded through corporate and foundation grants, UCSD joined forces with 6 other UC campuses to offer a 4-week residential summer science program for high-achieving, college bound high school students. COSEE CA oversaw the Scripps participation in the program (Scripps researchers as instructors for the ocean and climate related courses) for the first 2-3 years. Scripps scientists continue to participate as instructors in the program, which has now been in place for over 7 years.

COSEE West

University of Southern California

Located in the heart of Los Angeles, USC mirrors the city's diversity and global perspective. In the past fifteen years, USC has made a fundamental commitment to improving the community surrounding the university campus. These efforts resulted in the selection of USC as Time Magazine's 1999 College of the Year. Through these long-standing commitments, USC has forged strong links with K-12 schools throughout the greater Los Angeles area. As the centerpiece of marine and environmental sciences at the University, the Wrigley Institute for Environmental Studies continues a 106-year tradition in ocean sciences at USC and unites more than 80 scholars from the natural sciences, the social sciences and professional schools. The university continues to build its investment in ocean science, including the hiring of a cluster of seven new faculty in 2006. Research programs at the Wrigley Institute create innovative solutions to complex environmental issues while preparing undergraduate and graduate students to make connections between their research and potential improvements to the human condition. Outreach and education are therefore a major focal point of the Wrigley Institute, which espouses a "K-Gray" education philosophy. Programs such as summer science camps for middle and high-school students, Elderhostel programs, family science programs and class field trips at the Wrigley Marine Science Center, as well as a parent-child marine science program, marine science curricula, marine and environmental student science competitions, and teacher enhancement workshops, all play a major role in Wrigley Institute and Sea Grant activities, which keep five to eight full-time education staff extremely busy.

University of California at Los Angeles

UCLA has a distinguished recent history of research in ocean sciences and in outreach education. Pertinent particularly to this proposal are three education projects conducted over the past 10 years by UCLA in conjunction with NSF Teacher Enhancement (NSF-TE). These three projects were the UCLA Marine Science Teacher Enhancement Program (M-STEP), the UCLA Leadership in Marine Science program (LIMS), and Science Standards with Integrative Marine Science (SSWIMS). Each of these outreach efforts had a somewhat different focus, but all involved enhancement of K-12 teacher content knowledge in ocean sciences. Each program was based on the premise that chemistry, biology, physics, mathematics and earth and space sciences can be more readily appreciated and understood by elementary and secondary school teachers and students if these subject areas, traditionally presented separately and sequentially, are woven into an integrative and articulated, inquiry-based curriculum using the common theme of the marine environment. Some 500 K-12 teachers primarily from the LAUSD have participated in the UCLA programs during the past 10 years, and ocean sciences are now taught in many schools in the greater Los Angeles area. Each year UCLA's Marine Science Center takes approximately 2,000 students and their teachers to sea for educational oceanographic cruises on UCLA's RV Sea World.

The College of Exploration (TCOE)

The College of Exploration (COE) designed the current COSEE-West website. COE also creates the online environment on its website for COSEE-West's interactive web-based programs. COE videotapes COSEE-west public lectures and has uploaded years 1 and 2 lectures, with streaming

video and PowerPoint versions. Year 3 lectures are now posted. Visitors to the COSEE-West website may link to TCOE's web site to view these lecture without charge. In year 4 COE began webcasting live COSEE-West public lectures. COE created the online workshop environment for two COSEE-West online teacher workshops on coral reefs in 2004-2005, and one on harmful algal blooms in 2005-2006. In year 5 COE web cast live COSEE-West public lectures. COE created the online workshop environment for the COSEE-West online teacher workshops on polar ecology in April 2007. COE formally became part of COSEE-West when the COSEE-West renewal proposal was funded in Sept. 2007. COE created the online workshop environment for the COSEE-West online teacher workshop on coral reef ecology in spring 2008, climate change in November 2008, marine protected areas in March 2009, OOS in October-November 2009, coral reefs in Moorea in May 2010, evolution in the marine environment in November 2010, and harmful algal blooms in April 2011.

Informal Science Education Partners

COSEE-West has strong partnerships with local informal education centers, including the Cabrillo Marine Aquarium, the Aquarium of the Pacific, the Santa Monica Pier Aquarium, the California Science Center, SEA Lab, Ocean Institute, and the Natural History Museum of Los Angeles County. Visitor populations at these sites strongly match the demographics of the greater Los Angeles area, reaching an ethnically and culturally diverse audience of over 3.5 million students and visitors annually. Each of the informal education centers hosts field trips for K-12 students, teacher workshops, community events and outreach programs. Each center also has special qualities that make it unique: the Santa Monica Pier Aquarium, located on a pier in Santa Monica Bay, offers access to the beach and small scale teaching exhibits, the Aquarium of the Pacific in Long Beach has large teacher outreach programs including off-site field trips for teachers, the California Science Center offers the new Ecosystems wing with hands-on learning exhibits, the SEA Lab has aquaculture facilities and is part of the LA Conservation Corps, the Ocean Institute has ships for ocean research and hands on exhibits created in collaboration with scientists, the Natural History Museum has working research scientists, the most extensive marine collections on the West Coast (second largest marine invertebrate collection in the nation), and the Cabrillo Marine Aquarium offers a well-attended public lecture series and research training opportunities for high school students and undergraduates. Three of the centers are on the coast ranging from Long Beach to San Pedro (LA Harbor) to Santa Monica Bay, and two centers are located in inner city environs. These locations extend COSEE-West's ability to physically reach a large number and wide variety of students, teachers, and community members with a rich array of ocean sciences education, experiences, and opportunities.

The School Districts

UCLA, USC and all of our informal education partners already have good working relationships with a variety of school districts. Our closest relationship in the early years was with the Los Angeles Unified School District. This is the second largest school district in the United States with over 700,000 traditional students and a total student population of 906,789 (including after-school and continuing education). The ethnic make-up reflects the demographics of Southern California with 85% of the students in "minority" or under-served populations. LAUSD is

committed to improving science education and, for the past 15 years, they have encouraged the university-based programs created by UCLA and USC. LAUSD has now institutionalized this marine-science education process through internally funded in-service education support and resources, a significant step towards sustaining the goals of COSEE. Although the bulk of our efforts focus on LAUSD, we also have a strong partnership with the L.A. County Office of Education, which encompasses LAUSD and 79 other school districts (1 million students). We have programmatic relationships with smaller districts like Long Beach Unified, Palos Verdes Peninsula Unified, El Segundo Unified, Santa Monica and others. We have fostered these relationships to develop models for expansion of our successes in other demographic areas and to ensure that our COSEE-West activities are transferable beyond Los Angeles.

Los Angeles Unified School District

The LAUSD provided a salary point credit in-service course and attendance stipends for LAUSD teachers participating in COSEE-West's public lecture and teacher workshop series; provided venues for organizational meetings and workshops; worked with COSEE-West to identify local school district partners and sources of support to be provided by LAUSD; provided funding for training LAUSD teachers in integrating ocean sciences into their curriculum; funded the Bridging Program for 5th grade students transiting to middle school and has approved ocean sciences as the integrative theme for all subjects taught in that program. LAUSD released one teacher 50% time in 2003-2004 and two teachers 50% time in 2004-2005 and 2005-2006 to work with COSEE-West in creating and disseminating marine science curricula to LAUSD classroom teachers, and agreed to release two teachers again in 2006-2007. In year 5 the LAUSD provided a salary point credit in-service course and attendance stipends for LAUSD teachers participating in COSEE-West's public lecture and teacher workshop series; provided venues for organizational meetings and workshops; worked with COSEE-West to identify local school district partners and sources of support to be provided by LAUSD; provided funding for training LAUSD teachers to integrate ocean sciences into their curriculum. LAUSD provided funding for two science teachers to present marine science programs at workshops after school and on weekends, and released one high school science teacher to work with COSEE-West as an advisor for two days/week. Starting in year 6, LAUSD was unable to provide financial assistance because of drastic budget cuts. In years 6-9, LAUSD provided venues for organizational meetings and advertised COSEE-West events; worked with COSEE-West to identify local school district partners; provided equipment (laptop computers, dissecting microscopes) for professional development training sessions. In years 6-8, Marina del Rey Middle School in LAUSD Local District 3 hosted a five-day 'Introduction to Marine Science Seminar' in which scientists provided content lectures and COSEE-West mentor teachers presented activities. Year 6 focused on 6th grade California Science Standards; year 7 on 7th grade California Science Standards; and year 8 on 8th grade California Science Standards. LAUSD teachers and administrators are members of the COSEE-West Education Advisory Committee. LAUSD teachers comprise the majority of COSEE-West's teacher-participants and Mentor Teachers. This workshop built on the 'Introduction to Marine Science Seminar' offered in years 6-9 in which scientists provided content lectures and COSEE-West Master Teachers presented activities. LAUSD teachers and administrators are members of the COSEE-West Education Advisory Committee. LAUSD teachers comprise the majority of COSEE-West's teacher-participants and Master Teachers.

Natural History Museum of Los Angeles County
The LACNHM is a venue for COSEE-West public lectures, providing educational staff, security and audio-visual support, and parking. The museum also provides meeting space for our Education Advisory Committee meetings. The LACNHM received some funding from the USC COSEE-West grant to support these activities. In addition, LACNHM publicizes COSEE-West lectures in its newsletter, 'The Naturalist', which is distributed to over 20,000 people and on its website. Educational staff are members of the COSEE-West Education Advisory Committee. In year 5 the LACNHM was a venue for two COSEE-West public lectures and educators' post-lecture sessions, providing educational staff, security and audio-visual support, refreshments and parking. The LACNHM received some funding from the USC COSEE-West grant to support these activities. In year 6 the LACNHM included COSEE-West participants as special guests at a lecture by Jean Michel Cousteau. Ties to the Natural History Museum have been increased in year 7 through contact with Dr. Carl Selkin, the Vice-President for Education. The Museum has agreed to make its SEA Mobile available to COSEE-West workshops and programs. In years 7-9, it served as a venue for COSEE-West lectures.

California Science Center (CSC)
The CSC provided a venue, including staffing, security and audio-visual support, at a discounted rate for one COSEE-West public lecture in 2003. CSC educational staff are members of the COSEE-West Education Advisory Committee.

Aquarium of the Pacific Corporation (AoP)
The Aquarium of the Pacific (AOP) in Long Beach provided facilities for an introductory and planning meeting between COSEE-West and New England COSEE. The President of AOP has been strongly supportive of COSEE-West efforts. AOP education staff serve on the COSEE-West Education Advisory Committee. The AOP admits COSEE-West participants to its own public marine science events at a discounted rate. The AOP featured one COSEE-west lecture in its 2003-2004 public lecture series and provided classrooms for the related Saturday workshop. The AOP featured one COSEE-West lecture in its 2006-2007 public lecture series and provided educational staff to present activities in the related Saturday workshop. USC graduate students have helped AOP develop a special exhibit on marine plankton as a result of an exhibitry workshop that was held in year 5. USC and AOP also partnered on an award from NSF/EHR on Communicating Ocean Sciences to Informal Audiences (COSIA). The project involves a USC senior undergraduate/graduate level course which is co-taught by USC faculty and AOP staff and involved active engagement of the students at AOP with docents and visitors. The course was offered starting in spring 2007 and has been institutionalized as a course at USC. In years 8-9, AOP served as a venue for COSEE-West workshops.

Cabrillo Marine Aquarium (CMA)
COSEE-West continues its strong relationship with Cabrillo Marine Aquarium (CMA) co-hosting lectures and workshops together. CMA featured a COSEE-West lecture in each of its 2003-2004 and 2004-2005 public lecture series. CMA provided facilities and education staff for a COSEE-West workshop related to the year 3 lecture. CMA educators attend COSEE-West lectures and workshops and are members of the COSEE-West Education Advisory Committee.

CMA advertises its events on OceanList. COSEE-West staff provided technical assistance and a letter of support for a proposal submitted to NSF by CMA in 2003. In year 3 COSEE-West, CMA and LAUSD began discussions of using CMA internships as a Service Learning experience for LAUSD high school students in 2005-2006. In year 4 a COSEE-West teacher/participant connected three of his students with CMA staff to start internships. In year 5 CMA and COSEE-West co-hosted two workshops with public ocean sciences lectures and activities for K-12 educators, with CMA education staff presenting the activities. CMA and COSEE-West co-hosted a retreat for research scientists, K-16 educators and informal center staff in spring 2007. In year 6 CMA in San Pedro CA and COSEE-West co-hosted one public event at the Aquarium, a marine documentary film presentation with an educators' component. CMA co-hosted one workshop in June 2008 that included an ocean sciences research lecture open to the public and activities for K-12 educators. A third partner organization, the Channel Islands Marine Sanctuary, also co-hosted this workshop. In years 6-9, CMA and Sanctuary education staff presented the activities. CMA provided both a venue and professional development activities for the COSEE-West OOS teacher workshop in August 2008-2011. In May 2009 CMA presented its Suzanne Lawrenz-Miller Education Award to COSEE-West at its annual Grant Grunion Gala in recognition of COSEE-West's service to the education community in the greater Los Angeles area. In years 7-9, CMA served as a venue for COSEE-West workshops.

Ocean Institute (OI)

The Ocean Institute (OI) is an informal science center in Dana Point, California. OI collaborates with COSEE-West in publicizing ocean education events and promoting use of marine science in classrooms. The Senior Program Director of the OI attended the COSEE-West Retreat on Catalina Island in 2003 and was our host for COSEE-West's 2004 Retreat and 2005 workshop at the OI. Collaboration with the OI has enabled COSEE-West to extend its program beyond the Los Angeles area into Orange County. OI is an excellent venue for cooperative activities of COSEE West, COSEE California and other southern California marine science outreach programs because Dana Point is about half way between Los Angeles and San Diego. OI hosted a COSEE-West Retreat in the spring, 2004 (year 2) and a workshop in May 2005 (year 3), which were collaborative efforts of COSEE-West, OI, and the "Terra Clima" outreach program at the Scripps Institution of Oceanography. In years 6-9, OI provided the venue for COSEE-West's Informal Science Center retreat and its education staff assisted with activities at this event. OI provided both a venue and professional development activities for the COSEE-West OOS teacher workshop in August 2008-2010. In years 8-9, OI served as a venue for one COSEE-West Saturday workshop. OI advertises its events on OceanList and publicizes COSEE-West events to its audience.

Science Education Adventure (SEA) Laboratory

The SEA Laboratory in Redondo Beach, CA hosted one Saturday workshop in March 2003 and promises to provide its facilities for use without charge by COSEE-West whenever possible. SEA Lab and COSEE-West collaborate to publicize ocean education events and train educators to use inquiry-based marine science activities. The Director attended the COSEE-West Retreat on Catalina Island in 2003. In year 7, SEA Laboratory served as a venue for COSEE-West workshops and in years 8-9, SEA Laboratory served as a venue for COSEE-West lectures.

Santa Monica Pier Aquarium (SMPA)
The Santa Monica Pier Aquarium (SMPA) is managed by Heal the Bay, a nonprofit agency that promotes environmental action to improve the health of coastal ecosystems, particularly Santa Monica Bay. SMPA advertises its events on OceanList. Aquarium education staff members present marine science activities at COSEE-West workshops and are members of the COSEE-West Education Advisory Committee. One UCLA and two USC COSEE-West staff are on the Advisory Board of the Aquarium. The Santa Monica Pier Aquarium hosted the COSEE-West 'Oceans and Human Health' lecture in March 2003. The Director of Heal the Bay lectured on the same topic at COSEE-West's related Saturday workshop at the SEA Lab. COSEE-West and SMPA plan to expand program collaboration in year 5, with the Aquarium hosting a remote site for webcasts of live COSEE-West public lectures. In year 6 COSEE-West and SMPA co-hosted a series of four ocean sciences lectures for the public and co-hosted an ocean sciences lecture in year 7.

QuikSilver
QuikSilver has formed a partnership with USC's Wrigley Institute for Environmental Studies called the QuikScience Partnership, to improve K-12 science and environmental education in America. QuikScience provides financial support and in-kind contributions to enhance activities for COSEE-West. QuikScience activities for year 3 included the QuikScience Challenge, QuikScience Ocean Leadership Awards, sponsorship of the May 2005 "Shifting Sands" Workshop at the Ocean Institute, and support of the May 2005 Coral Reef Online Workshop. In year 4 QuikSCience sponsored a COSEE-West/QuikSCience kickoff event for teachers, educators and community members in October 2005 at the California Science Center IMAX theater. QuikSCience also helped pay year 4 lecture and workshop attendance stipends for non-LAUSD COSEE-West participants, supported the March 2006 HABs Online Workshop, and sponsored the QuikSCience Challenge and QuikSCience Ocean Leadership Award. QuikSCience activities for year 5 included the QuikSCience Challenge, QuikSCience Music Challenge, and QuikSCience/COSEE-West Ocean Leadership Awards, as well as a QuikSCience/COSEE-West kickoff event at the California Science Center IMAX theater for 400 attendees to promote ocean science education programs at USC. In year 6, the QuikSCience Challenge established a program in the New York-New Jersey-Connecticut tri-state regions in cooperation with COSEE-NOW led by Liesl Hotaling of the Beacon Institute. In year 7 and 8, a QuikSCience/COSEE-West hosted a kickoff event at the California Science Center IMAX theater. In 2009, Quiksilver Foundation renewed its commitment with a new two year, $400,000 award to USC Wrigley Institute for Environmental Studies.

Southern California Edison Company
The USC Wrigley Institute was awarded in 2006 a $1 million gift ($250K for 4 years) from Southern California Edison, a subsidiary of Edison International, for a new program called the Edison Challenge. The Edison Challenge has been held for four years and leveraged effective components of both COSEE-West and the QuikSCience Challenge, combining a team-based competition for middle and high school students with a series of professional development workshops for teachers. The Edison Challenge is offered to school districts within the Edison

service area, focusing on underserved groups and underrepresented students in the sciences. First place teams spent a week at the Wrigley Marine Science Center on Santa Catalina Island and participated in environmental and ocean science activities. The second place teams received a field study expedition to Edison's Big Creek Hydroelectric Facility in the Sierra Nevada Mountains for a week of fun activities and environmental sciences in a natural, pristine and secluded setting. Edison has funded a new project for 2010-2011 to focus on workshops for teachers who work with and serve predominantly African American Students.

American Cetacean Society
In Nov. 2004, co-sponsored a 7-hour workshop on marine mammals with COSEE-West in conjunction with the annual national conference of the ACS in Long Beach. Collaborates with COSEE-West in publicizing and providing marine science content and professional development opportunities.

California State University, Northridge
In years 2 and 3, provided lecture hall without charge for one public lecture each year.

Channel Islands National Marine Sanctuary
In year 1, the Sanctuary advertised its 'From Shore to Sea' lecture series on OceanList, the COSEE-West listerv for marine sciences educators. Sanctuary educators collaborated in the June 2008 workshop at CMA, training middle and high school teachers in protocols for collecting rocky intertidal and beach data developed by the National Marine Sanctuary's program LiMPETS ('Long-term Monitoring Program and Experiential Training for Students'). Sanctuary educators presented LiMPETS beach monitoring training to additional middle school teachers in August 2008. In year 9 the Sanctuary collaborated with COSEE-West to provide education about Ocean Acidification for their volunteers

Fort MacArthur Marine Mammal Care Center
In years 6 and 7, hosted one Saturday workshop

The Huntington Library, Art Collections, and Botanical Gardens
In year 7, hosted one COSEE-West public lecture

International Bird Rescue Research Center
In year 7, hosted one Saturday workshop

Ivy Academia Charter School
In year 8, hosted one COSEE-West public lecture

Jet Propulsion Laboratory
In March 2005, provided posters, CD-ROMS, information pamphlets to participants in a COSEE-West workshop on Satellite Oceanography and COSEE-West staff and JPL educators began discussions on ways to collaborate more fully, and will begin to implement some of these ideas in future years. Scientists from JPL lectured at COSEE-West lectures and workshops and hosted several workshops. COSEE-West partnered with JPL in two Climate Day events in 2008

and 2010. JPL education staff provided facilities, supplies, activities, A/V support. JPL education staff and COSEE-West staff planned both events in collaboration. JPL gave COSEE-West participants many materials and resources in support of the lecture and workshop activities. JPL provided a venue, a lecture by a JPL scientist, and professional development activities for COSEE-West's Ocean Observatory Institute in August 2008-2010.

KLCS TV
2003: Teacher's Corner TV program, 'Under the Sea and Into the Classroom,' Barry Kibrick, host
2005: 'Conversations with Richard Romer': Ron and Phoebe Ozuna discussing 'small learning communities' and teaching science and literacy using ocean themes on show hosted by LAUSD Superintendent Romer.

Los Angeles Maritime Institute (LAMI)
In May 2005, donated a cruise aboard its Tall Ship *Exy Johnson* for a COSEE-West field trip

Los Angeles River Center and the Friends of the Los Angeles River (FOLAR)
In year 7, hosted one COSEE-West public lecture

NASA
In year 3, discussion has begun with NASA educators about providing a COSEE-West workshop in year 4 that features the NASA funded "Ocean Surface Currents" web site/CD-ROM.

NOAA
Two presenters from the NOAA Office of Exploration presented a one-day workshop at the Aug. 2004 workshop for Master Teachers without charge. In year 4, one presenter from the NOAA Office of Exploration presented a one-day educators' workshop at the Natural History Museum of Los Angeles County without charge. In year 6 staff of the NOAA Office of Exploration worked with COSEE-West co-PI William Hamner, Peggy Hamner and Gwen Noda to develop a web site and lesson plans for a Signature Expedition to the Celebes Sea in October 2007. Results of this collaboration have been shared with COSEE-West participants in workshops and with other educators, students, and the public through the Office of Exploration's Celebes Sea Expedition website and Ocean Explorer workshops.

Santa Monica College
In year 4, hosted one COSEE-West public lecture

Santa Monica Public Library
In years 6 and 7, hosted four COSEE-West public lectures

Southern California Coastal Water Research Project (SCCWRP) Office
In year 8, hosted one COSEE-West public lecture and one Saturday workshop

Southwest Marine Educators Association (SWMEA)
SWMEA co-sponsored the COSEE-West Retreat on Catalina Island in Oct. 2004. Collaboration with SWMEA provided an opportunity to expand the geographical range of participants to include K-12 teachers and informal science from other areas in the southwestern United States. In years 5 and 8, SWMEA and COSEE-West collaborated to create a marine science strand of short courses, field courses and workshops at the California Teachers Association Conferences held in October 2007 and 2009. SWMEA recruited presenters and shared in supporting presentations at the Conference.

Terra Clima Outreach Program, Scripps Institution of Oceanography
In spring 2005, collaborated in planning and hosting the "Shifting Sands" workshop at the Ocean Institute. Presented an activity using the "Arena" sand kit and donated a kit to each workshop participant. In June 2007, at the request of COSEE-West staff, Scripps faculty and marine facility managers met with a COSEE-West teacher and his students and gave them tours of experimental facilities and Scripps research vessels. Staff at the Scripps Birch Aquarium also gave them a behind-the scenes tour of its facilities. COSEE California staff at Scripps helped arrange the tours.

COSEE Central Gulf of Mexico

During the fall 2002-2006, COSEE CGOM was funded by the National Science Foundation (NSF), *the Office of Naval Research (ONR), and the National Oceanic and Atmospheric Administration (NOAA)-National Sea Grant Program.* .

The NSF provided fiscal support for participants' costs for Mississippi, Alabama, and Louisiana, select COSEE:CGOM personnel, and the COSEE Scientist/Coordinator's position. During the first year of this ocean coastal sciences study, NSF also provided funds to develop and implement the COSEE:CGOM website. For Years 2 and 3, the webmaster's salary was cooperatively funded by NSF, ONR, and NOAA-National Sea Grant Program. During the second award (2006-2011) NSF provided the majority of funding with inkind funding provided by the U.S. Navy and NOAA-Sea Grant (the MS-AL and FL Programs).

During 2002-2006, the U.S. Navy's NAVMETOCCOM and NAVOCEANO provided personnel and oceanographic survey ships for "up to" three annual Sea Scholars/Teacher-To-Sea Voyages.

The ONR and the National Oceanographic Partnership Program (NOPP) provided fiscal support to add the states of Texas and Florida, which enabled this Regional COSEE CGOM effort to be expanded to all five states. It was originally planned to annually award six undergraduate internships provided by NAVMETOCCOM and NAVOCEANO (three undergraduate students per semester) to work 20 hours per week at the MS COSEE or at the U.S. Navy Offices at Stennis Space Center. Due to the U.S. Navy's funding reduction and recruitment difficulties, U.S. Navy internships were not awarded. Portions of personnel salaries were also provided by ONR/NOPP.

Other collaborators included the PI's and Co-PIs' host universities and/or marine laboratories.

These facilities in late fall 2002-2006 were: the University of Southern Mississippi-Gulf Coast Research Laboratory-Marine Education Center and Aquarium in Biloxi, MS; the Dauphin Island Sea Lab (DISL) and its Estuarium on Dauphin Island, AL; Mississippi State University (MSU) and its Center for Education Technology and Training (CETT) in Starkville, MS; the University of Florida-Gainesville and its Museum of Natural Science; the University of Texas (UT) and its Marine Science Institute (MSI) in Port Aransas; and the Louisiana Universities Marine Consortium (LUMCON) in Cocodrie. For the second COSEE CGOM award 2006-2011, these facilities include the USM-GCRL-Marine Education Center (MEC) in Ocean Springs, MS; the DISL; MSU; UF-Gainesville and its Museum of Natural Science; Loyola University and the Audubon Aquarium of the Americas in New Orleans; and the Institute for Marine Mammal Studies (IMMS)-Center for Marine Education and Research (CMER) in Gulfport, MS (2010-2011).

The NOAA-Oceanic and Atmospheric Research (OAR)-National Sea Grant College Program provided fiscal funds in late fall of 2002-2006 for part-time personnel and/or consultant salaries. During the second award (2006-2011), NOAA Sea Grant (MS-AL and the FL Sea Grant Program) provided inkind support for select personnel.

These NOAA funds allowed for Year 2 video conference implementation, the internal and external evaluation process, and materials and supplies. Various NOAA, ONR, and NSF scientists and/or educators were selected as guest speakers to include results from their respective research data. Through these partnerships, the original regional COSEE:CGOM submission was 'fully' funded for all three years.

During the first award (late fall 2002-2006), additional partners included: the National Marine Educators Association (NMEA); the National Science Teachers Association (NSTA); the FL, AL, MS, LA, and TX State Science Teachers Associations; the Marine Technology Society (MTS); the Sea Grant Network; the Consortium for Oceanographic Research and Education (CORE); the American Association for Limnology and Oceanography (ASLO); the American Geophysical Union (AGU); and the American Meteorology Society (AMS).

These professional organizations assisted this project in recruitment of program participants, in the dissemination of the results through their newsletters and websites, or through professional presentations at these conferences.

The State Departments of Education in each of the five, Gulf of Mexico states and the LA Public Broadcasting Station were also essential partners.

These State Departments of Education involved in the recruitment of participants and the dissemination of project results for the first award in late fall 2002-2006. The Mississippi Gulf Coast Community College, Jefferson Davis and Jackson County Campuses also participated in the recruitment of underserved undergraduate students. It should be noted that the University of New Orleans participated in recruitment efforts in Year 1 (2003). The primary listserve used for recruitment during the second award (2006-2011), were/are NSTA, NMEA, MTS, and the State Department of Education in MS, AL, FL, and LA, the Gulf of Mexico Alliance (GOMA), and the Gulf of Mexico Coastal Ocean Observing System.

Coastal America's-Coastal Ecosystem Learning Centers (CELCs) are represented by two of the four Informal Centers, they are the MEC and DISL.

The CELCs in AL and MS are also able to leverage personnel, programming, and exhibitry to enhance ocean and watershed literacy for a range of audiences.

Department of Navy-Naval Oceanographic Office (NAVOCEANO) and Naval Meteorology & Oceanography Command (NAVMETOCOM)-The Naval Meteorology and Oceanography Command (NAVMETOCOM) and the Naval Oceanographic Office (NAVOCEANO) provide one of its seven TAG-60 oceanographic survey ships for the Sea Scholars' seven to 10-day voyages.

Mr. Marcus Jarrett, Senior Navy Representative, for the Sea Scholars Program, has coordinated the implementation of the Sea Scholars Voyage and anticipates a voyage in 2011. Mr. Jarrett is also an instructor on the voyage, as is Dr. Sharon Walker and other NAVMETOCM and NAVOCEANO staff members. In 2006-2011, due to the wars in Afghanistan and Iraq, the U.S. Navy has only been able to fund Sea Scholars once in August 2006. It is anticipated a Sea Scholars Voyage in 2011 for "up to" 14 participants, one from each COSEE.

Mississippi-Alabama and Florida Sea Grant Programs are fully integrated within the COSEE:CGOM.

This integration is through time provided by Drs. Sharon Walker, Mike Spranger, John Dindo, Shelia Brown, and Jessica Kastler; the Educators at the DISL; and Ms. Karen Blyler, also with the FL Sea Grant and 4-H programs. This leveraging of personnel for K-Gray programmatic implementation has been/is exemplary.

The COSEE:CGOM Advisory Board is an essential partner in the success of COSEE CGOM.

This Board is represented by 12 members, (three representatives from each state i.e., state science coordinators, classroom teachers/parents, scientists, and/or an informal educators) these members are listed below:

AL-Ms. Sharon Delchamps, Murphy High School, High School Teacher, Mobile; Ms. Laura J. Linn, DISL Educator and Parent, Mobile; and Mr. Lloyd Scott, Director, Mobile County Environmental Education Center, Mobile.
FL-Ms. Kimberly Walden, Escambia County Schools, Science Coordinator, Pensacola; Ms. Charlene Mauro, High School Teacher, Navarre High School, Navarre; and Dr. Donald C. Behringer, Jr., University of Florida, Scientist, Gainesville.
LA- Ms. Tina Savoie, South Cameron High, South Cameron Parrish Schools, Teacher, Grand Chenier; Dr. Frank Jordan, Loyola University, Scientist, New Orleans; and Ms. Charlotte R. Bihm, St. Landry Parish School Board, Opelousas.
MS-Ms. Belinda Matlock, Lamar School, Middle School Teacher, Meridian; Mr. John Bowie, EPA-Gulf of Mexico Program, Informal Educator/Parent, Stennis Space Center; and Dr. Richard S. Fulford, USM, Department of Coastal Sciences, Scientist, Ocean Springs.

The COSEE CGOM has worked with an average of 30 different scientists annually for the last eight years, representing different universities, agencies, and/or marine laboratories. In annual reports to NSF (2003-2009), these scientists are listed by date and types of interaction, i.e., collaborating on Summer Face-to-Face and Online Institutes, Two-Day Workshops, and through interactions with the public in the Informal Centers as well as providing resources, and inkind support have been instrumental in achieving success of the goals and objectives of the first (fall 2002-2006) and second COSEE CGOM awards (2006-2011).

Existing partnerships have been expanded to encompass a COSEE CGOM electronic newsletter from 2008-2010.

Newsletter articles about COSEE CGOM events were prepared for the National Marine Educators Association (NMEA), the Marine Technology Society (MTS), National Science Teachers Association (NSTA), and State Departments of Education in Louisiana, Florida, Mississippi, Alabama, and Texas for marketing COSEE CGOM and recruitment of teachers. Greater emphases were placed on scientist engagement with teachers and the public in the second COSEE CGOM award (2006-2011). In addition to fall recruiting in 2002-2005 and in 2006-2011 through NMEA, NSTA, MTS, and the regional NMEA Chapters (Texas Marine Educators Association [TMEA], Southern Association of Marine Educators [SAME], and Florida Marine Science Educators Association [FMSEA]), the PI and Co-PIs also used/use the Gulf of Mexico Alliance (GOMA) and Gulf of Mexico Coastal Ocean Observing System (GCOOS).

FLEXE: GLOBE – Dr. Sharon Walker was contacted by Dr. Liz Goehring from Pennsylvania State University in 2008. Dr. Goehring requested that COSEE CGOM collaborate with FLEXE GLOBE to provide Professional Development (PD) on methane hydrate research findings in the Gulf of Mexico for formal and informal educators.

Dr. Shelia Brown coordinated the FLEXE: GLOBE: From Local to Extreme Environments Workshop in July 21-22, 2009. This Two-Day Workshop was a partnership between Temple University, the University of Southern Mississippi, and COSEE CGOM. The Workshop was funded by the NSF's GLOBE (Global Learning and Observations to Benefit the Environment) Project, the Mineral Management Service, and NOAA. There were 26 applicants and 18 participants. The composite Likert-scale evaluation of Workshop activities revealed participant responses as 68% Very Valuable, 31% Valuable and 1% Average Value. The ethnicities of these 18 participants (15 sciences, 2 math and science, and one science education) were: African American (2), Caucasian (11), Asian American (4), and Hispanic (1). The participants were offered continuing educational units (CEUs); however, no one wished to take this two-day Workshop for credit.

COSEE Florida (2002)

American Express National Arts Marketing Program;
Bay Soundings;
Broward County Public Schools;
Busch Gardens;
Campbell Park Elementary Marine Science Program (school);
Camp Bayou Outdoor Learning Center;
Cantanese Center for Urban and Environmental Solutions at Florida Atlantic University;
CHRONOS Mesozoic/Cenozoic paleoceanography and paleogeography workshop – (COSEE FL participant in)
City of Clearwater;
City of Largo Nature Parks;
Current Publishing;
Dade County Public Schools;
FAMU Developmental Research School;
"Florida Building A Presence" Teacher Leadership Network
Florida Fish and Wildlife Conservation Commission;
Fish and Wildlife Research Institute (FWC);
Florida Institute of Oceanography;
Florida Institute of Technology;
Florida Ocean Alliance;
Florida State Department of Education;
Florida Sea Grant;
Franklin County Public Schools;
Gadsden County Public Schools;
Gumbo Jumbo Environmental Complex;
Harbor Branch Oceanographic Institute;
Hillsborough Community College;
Hope Botterbusch, Coordinator Research Program/Services, College of Marine Science
Joseph Foundation, Inc.;
Leon County Public Schools;
Manatee Viewing Center;
Marine Lab in Key Largo, Fl;
Moccasin Lake Nature Park;
MOTE Marine Laboratory;
Museum of Science and Industry;
Myflorida.com;
Nature's Classroom;
NOAA/NMFS;
NOAA Undersea Research Center Aquarius;
Office of Coastal and Aquatic Managed Areas, Florida Department of Environmental

Protection
Pier Aquarium;
Pine Jog Environmental Center;
Pinellas County 4-H;
Pinellas County Environmental Fund/NOAA ;
Pinellas County Public Schools;
Professional Association of Diving Instructors;
Royal Caribbean Cruise Lines.
Science Center of Pinellas County;
Skool-Tek Corporation
Solutions To Avoid Red Tide, Inc.;
Southeast Atlantic Coastal Ocean Observing System;
Southwest Florida Water Management District;
Tampa Bay Estuary Program
The Florida Aquarium;
The Florida Caucus;
University of Florida;
University of Central Florida;
University of North Florida;
University of West Florida;
United States Geologic Survey

COSEE SouthEast

COSEE SE is a regional center and its success is based on functional and active partnerships. COSEE SE has identified two types of partners. (1) Permanent partnerships are those who have continually provided support (in-kind, fiscal, advisory) and provided introductions to key people in the scientific and educational institutions in the regions. These include the Sea Grant programs in NC, SC and GA, UGA Marine Extension Service, and SC Department of Natural Resources, North Carolina State University. Event-driven partnerships are those in which COSEE SE partners with an institution or agency and its people to coordinate and implement an activity. In addition, COSEE SE has diverse partnerships that divide into informal science institutions, such as aquariums and museums (Table 1), research institutions, such as universities and state agencies (Table 2) and educational institutions (Table 3).

A. COSEE SE has partnered with a series of **informal science centers** and other entities since 2003 in order to extend information from the summer, residential workshop, Ocean Sciences Education Leadership Institute to local institutions. These institutions are called SEPORTS (South East Portal for Ocean Research to Teachers) and they host the one-day Ocean Awareness Days (OADs). OADs, which are extension requirements of educators who participate in the Institute. Participants/educators coordinate a 6-hour professional development day in partnership with the informal science center. SEPORTs provide opportunities for scientists, ocean science resources, and are often partners in proposals. Table 1 lists by state the informal education centers that have participated with these Ocean Awareness Days since 2003 and their periods of engagement.

Table 1. Informal Partners and Periods of Engagement

Informal Partners -SEPORT s	03-04	04-05	05-06	06-07	07-08	08-09	09-10
South Carolina							
SC Coastal Discovery Museum Hilton Head					x		
SC Roper Mt Science Center, Greenville			x	x		x	x
SC Aquarium, Charleston			x		x	x	x
SC DNR MRRI, Charleston	x						
SC State Museum, Columbia	x				x	x	

SC NOAA HML, Charleston	x	x					
SC CCU Waites Island, Conway				x	x		
SC ACE Basin, Colleton	x	x					
North Carolina							
NC Zoo, Ashboro		x	x	x			
NC ECU Math/Science Center, Greenville	x						
NC Sturgeon City, Jacksonville			x				
NC Discovery Place, Charlotte	x	x	x				
NC Catawba Science Center, Hickory		x					
NC Estuarium, Washington	x	x					
NC Museum of Natural Sciences, Raleigh	x	x	x	x	x	x	x
NC Aquarium Ft Fisher, Wilmington				x		x	x
NC Rocky Mt Children Museum, Rocky Mount							x
NC Maritime Museum, Beaufort						x	
NC Nat Science Center Greensboro	x						
NC Aquarium PKS, Morehead City					x		
NC Piedmont Env Center				x			
NC Allison Woods Nat Center		x					
Georgia							
GA Ocmulgee NM				x			
UGA MECA MAREX, Savannah	x	x	x	x	x	x	

GA Sandy Creek Nature Center			x				
GA Aquarium, Atlanta							x
GA Aviation Museum	x						
GA Sapelo Is NERRS, Savannah						x	
GA Gwinnett Heritage Center						x	
GA Fernbank, Atlanta	x	x	x	x			
GA West GA Carrollton	x	x	x		x		
GA Chattahoochee RESA , Atlanta					x		
GA Crooked River, St. Marys		x		x			
GA Cumberland Is NPS, Brunswick							x
GA SSU, Savannah							x
U Puerto Rico, Mayaquez		x	x				

B. COSEE SE has partnered with universities and research components of state and federal agencies. **Regional research institutions and agency partners** provide our connections with scientists who contribute the scientific expertise for professional development opportunities since 2003. In addition, these researchers get email communication and announcements from COSEE SE and this has led to partnerships with COSEE SE in broader impacts sections of proposals and development of regional, state and institutional projects. COSEE SE has made an effort to partners with HBCUs and thus has worked with Savannah State University, South Carolina State University and Elizabeth City State University. COSEE SE has assisted faculty at SSU in their NSF GK-12 project for two years.

In North Carolina, COSEE SE has partnered with the following universities and marine laboratories:

NCSU and CMAST, Raleigh, NC; UNC-CH and Institute of Marine Science, Chapel Hill, NC; UNC-W and Marine Science Institute, Wilmington, NC; Duke University Marine Lab, Beaufort, NC; East Carolina University, Greenville, NC; NC Sea Grant, Raleigh, NC; Elizabeth City State University, Elizabeth City, NC.

In South Carolina, COSEE SE has partnered with the following universities and marine laboratories:

College of Charleston, Grice Marine Lab and Avery Research Center for African-American History & Culture, Charleston, SC; University of South Carolina and Baruch Marine Science Laboratory, Columbia and Georgetown, SC; Clemson University, Clemson, SC; Medical University of South Carolina, Charleston, SC; South Carolina State University, Orangeburg, SC; SC Department of Natural Resources, ACE Basin NERR, Charleston County Parks and Recreation Commission, Caw Caw Interpretative Center. In addition, COSEE SE has worked with the Charleston WaterKeeper, Gullah/Geechee Sea Island Coalition on St. Helena Island, SC; SC Maritime Foundation: Spirit of SC

SC Sea Grant Consortium; SEWEE Environmental Education Center, Awendaw, SC
SC Commission on Higher Ed/GEAR UP, Columbia, SC.

In Georgia, COSEE SE has partnered with the following universities and marine laboratories:
University of Georgia, Athens, GA; Skidaway Institute of Oceanography, Savannah, GA; University and College of West Georgia, Carrollton, GA; Savannah State University Savannah, GA

C. COSEE SE has partnered with **formal education organizations and agencies** which have supported professional development opportunities in the region. Partnerships include formal education teachers, school district and state department of education leads. In addition, COSEE SE keeps in communication with science education researchers at universities to maintain communication for most effective practices for all events. Table 3 shows the school district and state department partnerships within the region that have had formal partnerships. Educators in the PD programs come from many school districts in the 3- state region. Our strongest partners and advocates for program development, recruitment and certification have come from people in administrative positions in state and county systems:
Charleston County School District, Charleston, SC; SC Dept of Education, Columbia, SC; SC State University/Felton Lab School, Orangeburg, SC; NC Dept of Public Instruction, Raleigh, NC; and GA Department of Education, Atlanta, GA

COSEE Ocean Learning Communities

Sound Citizen

SoundCitizen is a program that brings citizens and undergraduate students together to investigate regionally significant questions on the connectivity between watersheds and receiving waters in the Puget Sound region. Citizen volunteers participate at a variety of levels. SoundCitizen's motto is that "*Students and Citizens can work together to conduct significant research."* The research theme for SoundCitizen is to understand the transport of organic compounds (natural and pollutants) from the Seattle Metropolitan Area into Puget Sound through gutters, storm drains, streams, rivers, rainwater and sewers. SoundCitizen was started through COSEE-OLC efforts but is financially independent from COSEE-OLC. Since November 2008 more than 250 adult volunteers and 600 K-12 students have volunteered for SoundCitizen and more than 600 samples have been processed for emerging pollutants and geochemical characterization of marine waters. The effort has resulted in three peer-reviewed publications (Keil and Neibauer 2009, Kimball et al 2009 and Salemme 2010).

Pt. Townsend Marine Science Center (PTMSC)

PTMSC leaders and volunteers have been an active part of our ocean learning community from its inception in 2007 by attending and participating in our workshops, events and Ocean Inquiry Project research cruises. In 2009 we partnered with the PTMSC, Washington Sea Grant and the Puget Sound Partnership to provide a two day workshop in Port Townsend on Citizen Science. The workshop was attended by over 170 marine organization leaders and volunteers, ocean and marine scientists, resource managers, graduate students and informal and formal educators.

LIFE Learning Sciences Research Center

The Learning in Informal and Formal Environments (LIFE, http://life-slc.org/) Center is an interdisciplinary effort funded through NSF's Science of Learning Center program. The LIFE Center—a close collaboration between the University of Washington, Stanford University, and SRI—has a broad set of interdisciplinary research projects underway seeking to fully articulate and synthesize our theoretical accounts of how people learn socially across settings, pursuits, and domains. The research findings, resources, and personnel associated with LIFE are leveraged in COSEE OLC work.

Washington Sea Grant (WSG)

Washington Sea Grant located on the University of Washington campus has been an active part our ocean learning community. In 2008 we began a formal partnership with WSG with co-hosting the "Communicating Ocean and Marine Science Workshop" bringing together ocean/marine scientists, marine organization leaders/volunteers and formal/informal educators. In 2009 WSG was one the three partners for our two day workshop in Port Townsend on "Exploring the Spectrum of Citizen Science". And in 2010 WSG co-hosted with our Center the day and a half workshop "Addressing Broader Impacts Requirements for Research Proposals". Other COSEE-OLC partnership activities with WSG have included the Washington State Ocean Science Bowl, co-teaching the Communicating Ocean Science and Communicating Ocean

Science with Informal Audiences courses at the University of Washington as well as ongoing work related to citizen science efforts in the Puget Sound region.

Ocean Inquiry Project
Ocean Inquiry Project (OIP), a non-profit organization in Puget Sound, WA, delivers inquiry-style marine science education using a hands-on curriculum while gathering research-quality data in Puget Sound for scientific partners. A collaboration between COSEE Ocean Learning Communities and OIP is bringing together ocean researchers, volunteers from environmental organizations, informal educators, and local youth groups for day-long field-research learning experiences on Puget Sound. These field experiences strive to give the diverse participant groups a better appreciation for the process of science, how oceanographic data is collected, and an increased understanding of the Puget Sound ecosystem and the role humans play in the ecosystem's health. This collaboration has benefited the non-scientists and scientists alike.

UW Institute for Science and Math Education
The University of Washington Institute for Science and Mathematics Education creates partnerships to envision, cultivate and study equity-oriented educational practices in areas of science, technology, engineering and mathematics (STEM). The institute is guided by three core commitments: (1) create and maintain deep, mutually-beneficial collaborations between STEM educators, STEM disciplinary experts, learning scientists, and community organizations, (2) build educational practice upon the strongest research-based accounts of STEM learning and teaching as it occurs in formal and informal environments, and (3) challenge ourselves, our partners, and the STEM education communities to transcend long-standing patterns of inequity in STEM learning. The Institute partners with schools, informal educational organizations, and numerous individuals and organizations with rich STEM expertise across the university community and our region and state. The involvement of Bell and Tzou's team in COSEE OLC happens through the UW Institute for Science and Math Education. Philip Bell directs the Institute and he and Tzou are both Co-PIs of COSEE OLC.

Puget Sound Partnership
The Puget Sound Partnership (PSP) was convened by Washington State governor, Christine Gregoire, to bring citizens, scientists, governments, tribes and business together to address the protection and restoration of Puget Sound. The COSEE-OLC mission of building non-traditional ocean learning partnerships and encouraging those communities to innovate, communicate and build partnerships among themselves closely aligns with PSP goals. During COSEE-OLC formative years, regional marine volunteers were identified as a key audience and the primary line of work for the Seattle Aquarium. PSP sought close connection with that group as well which developed into to the formation of the PSP Education Communication Outreach Network (ECO Net). COSEE-OLC has been a participant in ECO Net from its conceptual stages to the present and continues to work with PSP in supporting and growing its work. This partnership catalyzed the COSEE-OLC collaboration to design and implement an innovative series of events that provided ocean scientists with strong opportunities to reach citizens with their research and to learn from those citizens more about effectively communicating ocean science to a non-science audience. Among those events were Communication Ocean Science and Exploring the Spectrum of Citizen Science which reached ocean, marine and learning scientists, leaders and

volunteers of marine organizations, resource managers and educators. The impact on scientists of these events has been assessed and documented through extensive evaluation work.

OACIS GK-12 Program
COSEE-OLC has been partnering with the Ocean and Coastal Interdisciplinary Science (OACIS) GK-12 program at UW since it's beginnings. COSEE-OLC advised on the preparation of the proposal that funded OACIS GK-12, COSEE-OLC PI Phil Bell serves on the OACIS GK-12 external advisory committee, COSEE-OLC PI Carrie Tzou offers professional development to OACIS GK-12 fellows, COSEE-OLC E&O specialist also serves as the OACIS GK12 Program Manager, and through this split appointment ensures that OACIS Gk-12 teachers, fellows, and staff are included in the COSEE-OLC learning community. Tansy Clay teaches the training course for OACIS Gk-12 fellows, which draws heavily on content and resources from the COSEE Communicating Ocean Sciences class. Carrie Tzou, Tansy Clay, and other COSEE-OLC staff recently collaborated with OACIS GK-12 teachers and fellows to develop and field test a high-school level placed-based environmental/marine science curriculum.

OEDG: Sound Citizen Science Apprenticeship Program (SCSA)
The Sound Citizen Science Apprenticeship Program (SCSA) is a 2-year partnership between SoundCitizen, the UW Institute for Science and Mathematics Education and two youth groups in Seattle—YMCA BOLD and Passages Northwest. SCSA "infuses" geosciences research and mentorship experiences into existing out-of-school activities for first-generation immigrant, Latino and African American youth, ages 12-17, from urban neighborhoods in the Seattle area. The PIs are Rick Keil, Phil Bell and Andy Shouse. The students running the program are Deana Scipio and Shelley Stromholt. Last year we had 8 apprentices at the UW every Tuesday evening. Beginning this fall we will try something a little different and have 12-15 middle school students from Mercer Middle School and we will go to their school.

UW SACNAS
UW SACNAS is the student chapter of the national organization, Society for Advancement of Chicanos/Latinos and Native Americans in Science (SACNAS). Their mission is to promote diversity in the sciences. The national organization was founded by Chicano and Native American scientists; however, the chapter welcomes and includes everyone who is interested in promoting diversity in science. The student chapter here at UW was formed over a year ago and our main objectives are to recruit and retain underrepresented minority students in the sciences at UW and provide a network of support and resources for current students. COSEE OLC has partnered with the UW SACNAS chapter to help develop culturally responsive curricula for high school students, to put on professional development workshops for scientists on broadening participation in science, and to disseminate research findings through academic channels.

Environmental Educators Association of Washington (EEAW)
EEAW works throughout the state of Washington to promote and support environmental education both in formal and informal settings. EEAW as an organization has historically had

more of a terrestrial and watershed based focus. Through conversation, discussion and participation via the Seattle Aquarium and COSEE-OLC, EEAW has worked to integrate more ocean and marine content into efforts. In 2007, COSEE-OLC partnered with EEAW to host an event at the Seattle Aquarium, "An Evening with Sylvia Earle" as part of the EEAW annual conference. This was a blending of EEAW members and members of COSEE-OLC's ocean learning community resulting in over 300 people participating. In 2009, COSEE-OLC's principle investigator, Philip Bell, gave a keynote presentation at the annual EEAW conference.

COSEE Great Lakes

COSEE GL has worked with nearly 70 different groups as collaborators/partners over our 5 years of operation in the region. In annual reports to NSF these are listed by date and type of interaction, such as providing facilities, speakers, in-kind support, sharing resources, contributing funds or personnel, collaborating on workshop efforts, etc. In a region with 8 large states, this broad range of interactions is essential to reach substantial numbers of scientists and audiences. None of the interactions have been trivial; all were essential to the program's mission and success.

This report focuses on a small portion of our range of partners, not to diminish the value of others, but primarily as a means of demonstrating substantive research interactions in areas largely unreached by NSF's GEO-OCE programs.

The Research Institutions/Laboratories we have partnered with include NOAA Office of Sea Grant, NOAA Great Lakes Environmental Research Laboratory, US Environmental Protection Agency – Great Lakes National Program Office.

NOAA Office of Sea Grant
Since most of the staff are Sea Grant employees in their respective states, 50% of funding for our COSEE GL program is contributed by NOAA. As a result, each Sea Grant program in the GL Network provided match: $1 for every $2 in NOAA funds. NOAA, then, provided $1.25M and state Sea Grant programs an additional $0.75M to be eligible for NSF's 50% funding of $1.25M. While this insured state buy-in to the COSEE program and provided access to many research scientists in the region, it resulted in reporting and responsibilities that were above those of other COSEEs. Because staff members are experienced Sea Grant educators, and were excited to work across state boundaries for NSF goals, this was considered an appropriate arrangement.

The Sea Grant – NSF partnership was thus a substantive one. It enhanced the stature of Sea Grant educators and allowed them to pursue activities that were regional and national. [Sea Grant funds are for state efforts.] The partnership lifted traditional professional development efforts to include greater emphasis on research science and to engage scientists from many institutions. By focusing on a LAKE or the REGION rather than a state, and by deliberately seeking multicultural perspectives, staff learned new skills and made new contacts that will continue after NSF funding. Our status as facilitators of scientists' engagement in communities and with educators has been enhanced, and there is greater respect for outreach efforts from multiple sources. Since NSF funding will not be available to us in coming years, we have begun to seek other ways of working regionally, and several multi-state funding opportunities are in place or being pursued.

Sea Grant institutions involved in the program are listed here. State Sea Grant programs are generally located in the Land Grant institution in each state.
Great Lakes Sea Grant Network
Ohio Sea Grant, The Ohio State University
New York Sea Grant, Cornell Extension office
Pennsylvania Sea Grant, Great Lakes office in Erie PA
Michigan Sea Grant, Michigan State and University of Michigan
Wisconsin Sea Grant and WATER Institute, University of Wisconsin - Madison and Milwaukee
Illinois-Indiana Sea Grant, University of Illinois
Minnesota Sea Grant, University of Minnesota – Duluth

NOAA Great Lakes Environmental Research Laboratory [GLERL]
GLERL served to ground the COSEE GL program in high quality Great Lakes science on a broad spectrum of theoretical and applied topics. Dr. Rochelle Sturtevant was our science coordinator from her position there, and the research scientists were very receptive to opportunities for broader outreach through COSEE GL efforts. They participated in the School for Scientists, Educator House Calls, and as resource people for professional development workshops. Two Advisory Committee meetings were held in GLERL facilities, and Sturtevant's budget supported numerous scientists to make presentations for education audiences. She is coordinating our GL Education Summit, the culminating activity of COSEE GL in September 2010, and is our representative for SEW-G and the 2010 Best Practices workshop.

USEPA-GLNPO [Great Lakes National Program Office]
When the COSEE GL proposal was written we did not expect to have more than minimal access to on-the-water research through EPA's research vessel, the R/V Lake Guardian. Instead, EPA personnel embraced the opportunity for input to and experience with education, to the point where the agency donated use of the boat and crew for a full week each year for a full-scale professional development program for educators. This was a $180,000 contribution annually to the COSEE GL program. We only paid for meals.

The Shipboard and Shoreline Science Workshop quickly became the highlight of our program, because several research scientists led activities aboard the Guardian for a full week each summer. Living aboard a working research vessel, learning from scientists as they did their own research and shared information about their careers and their field, provided educators with life-changing experiences. For their part, the researchers were impacted too, learning about teachers' training and experience levels and their teaching conditions, responding to thoughtful basic questions, learning about Standards and pedagogy, and helping many educators experience the research process for the first time. The ultimate in collaboration experiences, both educators and scientists saw those from the other profession as people, and got to know them in both professional and personal ways. Researchers learned how to be more effective communicators, and educators overcame their tendency to feel inferior to scientists. Both professions were able to contribute to each others' growth and experience.

Personal reactions to the experience were posted on a blog by the educators at http://coseegreatlakes.net/weblog and several articles about previous Guardian workshops are at the NEWS section of the website. Scientists who distinguished themselves in COSEE GL programs on the Guardian were Drs. Elizabeth Hinchey Malloy, Greg Boyer, Joel Hoffman, Tomas Höök, Bill Edwards, Beth Murphy, and water quality expert Jackie Adams.

Informal Science Education Institutions

Each state in COSEE GL worked with one primary informal science education facility for programming, facilities and resources. These included:
NY: Aquarium of Niagara, Buffalo
PA: Tom Ridge Environmental Center, Erie
OH: Great Lakes Science Center, Cleveland
MI: Thunder Bay National Marine Heritage Site, Alpena
IN: Indiana Dunes National Park, Porter
IL: John G. Shedd Aquarium, Chicago
WI: Pier Wisconsin and the SV Denis Sullivan, Milwaukee
MN: Great Lakes Aquarium, Duluth

These facilities served as sites for workshops and team meetings, student field trips supported by COSEE GL, community programs like Science Saturday in Chicago. Their education staff members served on our Advisory Committee and assisted us in planning for outreach to informal educators and multicultural groups. Applicants from their facilities were given priority for workshop participation. In addition, we advertised their Great Lakes and ocean programs, and they advertised ours to their listervs.

In addition to these primary informal partners, COSEE GL supported the work of many other informal education providers in the region as we offered to fill what Dr. Don Elthon called "the $400 gap." That was the approximate cost of a bus to get students to places where they could experience marine and aquatic science themselves outside the classroom. Each state had access to funds to support student groups for field trips to GL/ocean science experiences. Here are some examples of partner programs that provided such education for COSEE GL supported students:

- Schoolship programs: BaySail [WI], Discovery World's SV Denis Sullivan [throughout the lakes], Spirit of Buffalo [Buffalo Urban Outdoor Education], Inland Seas Education Association [Suttons Bay MI]
- Nature Centers: Tifft Nature Center [Buffalo, stream ecology]; Hartley Nature Center [Duluth, conservation through water recreation]
- Special GL programs: Alliance for the GL – Adopt a Beach Program; F.T. Stone Laboratory – student workshop program; Seaborg Center – Native American programs
- Student research conferences: GL Student Summit and Lake Superior Summit, in alternate years

College/University Formal Education Institutions

The institutions housing Sea Grant programs in the region were partners in programming and supported the efforts of COSEE GL in myriad ways. Not only were they providers of standard support expected from indirect costs [phone, printing, mailing, office space, etc.], they also facilitated travel for their Sea Grant research scientists and identified NSF researchers for COSEE programs. The University of Illinois hosted a service learning course co-taught by COSEE staff on aquatic invasive species. Undergraduates learned the science and then taught programs for K-12 classes on that topic.

COSEE Ocean Systems

Bangor School Department, Maine Administrative School District (MSAD) #11, and Alternative Organizational Structure (AOS) 92
These three school administrative units in Maine have partnered with COSEE OS to explore ways to build ocean science themes into school curricula. Over the next two years, teachers from these communities (Bangor, Gardiner, Pittston, Randolph, Vassalboro, Waterville, West Gardiner, and Winslow) will work with COSEE OS staff to find novel ways to infuse marine topics into their curricula and will have access to valuable ocean science resources and programs at research institutions in Maine.

Bigelow Laboratory for Ocean Sciences
Bigelow Lab has been an active partner since COSEE OS was launched. Senior Research Scientist, Michael Sieracki, presented at early workshops and provided scientific review of educator resources. David Fields, another Senior Research Scientist, is also a collaborating partner through his oversight of the long-established Keller-BLOOM program that allows 16 high school juniors each year to conduct laboratory and field studies, including a one-day research cruise. COSEE OS will expand the reach of this program by sponsoring two high school juniors per year from COSEE OS partner schools to participate.

Bowdoin College
Collin Roesler, Associate Professor of Geology, collaborated as a participating presenter at a workshop and in testing of COSEE OS software in liberal arts courses.

COSEE California, COSEE NOW, and COSEE-West
In collaboration with three other COSEE centers, COSEE OS has engaged in a national effort to offer graduate students a professional development experience that is designed to help them hone their skills at communicating scientific expertise to non-scientist audiences. This is being done through the called the "Faculty-Graduate Student Collaborative Workshop" model developed by COSEE OS. The other PI's on this project are Linda Duguay, Janice McDonnell, and Cheryl Peach.

Gulf of Maine Ocean Observing System (GoMOOS)
GoMOOS was a national pilot program designed to bring hourly oceanographic data from the Gulf of Maine to all those who need it. Before it was discontinued in 2009, its Chief Operating Officer, Tom Shyka, partnered with COSEE OS in preparing an exhibit and co-sponsoring the "Seasons in the Sea" teacher workshop at the University of New Hampshire in 2006 and the subsequent "Climate and Oceans – Using Ocean Based Data" workshop.

Harvard University
Dr. Peter Girguis, Assistant Professor, Department of Organismic & Evolutionary Biology, engages in ongoing collaboration with COSEE OS. He served as a scientific advisor on software

development and continues to partner with the Center by giving science presentations at conferences, workshops and webinars.

Institute for Broadening Participation (IBP)
As one of the core partners on the National Science Foundation (NSF) renewal grant, IBP Executive Director, Ashanti Johnson (also acting as COSEE OS Associate Director), is collaborating with COSEE OS in conducting outreach to underrepresented minorities (URMs) in science, technology, engineering and mathematics (STEM) fields. Additional partners are, Susie Valaitis (Associate Director) and Liv Detrick (Assistant Director).

Maine Mathematics & Science Alliance (MMSA)
The Maine Mathematics and Science Alliance promotes excellence in K-16 STEM education through professional development with teachers and other educational leaders. They translate research and educational standards into effective teaching and learning practice statewide and across the nation. Under the guidance of the past and present executive directors, Francis Eberle and Janice Mokros, MMSA has advised COSEE OS on education research efforts and has partnered in research grant proposals.

Monterey Bay Aquarium Research Institute (MBARI)
MBARI is a world center for advanced research and education in ocean science and technology and it develops instruments, systems, and methods for scientific research in the deep waters of the ocean. COSEE OS partnered with MBARI's Senior Education & Research Specialist, George Matsumoto, in co-sponsoring the "Climate and Oceans – Using Ocean Based Data" workshop. The partnership involved MBARI's program "EARTH," a professional development program that uses real time ocean-observing data for teachers in the classroom.

Mount Desert Island Biological Laboratory (MDIBL)
With a permanent staff of about 60, MDIBL is the largest coldwater research facility in the Eastern US for the study of various aspects of marine and freshwater fauna physiology. In addition, MDIBL houses a Program in Marine Conservation and Environmental Science. Through this program, MDIBL offers a variety of education and outreach programs for teachers and students with interest in marine ecology. Our partner at MDIBL is Jane Disney, Director of the Community Environmental Health Laboratory. She has formulated various programs to offer teachers and students in our partner school districts.

New England Institute of Art
Robert Khederian teaches oceanography at the New England Institute of Art in Brookline, MA. After learning about concept mapping from COSEE OS at an Ocean Literacy Summit, he used and tested the Center's software with his non-traditional audiences at the Institute. He then created a concept map based question for a final exam to assess the students' ability to connect concepts presented throughout the entire semester-long oceanography survey course.

New England Aquarium (NEAq)
COSEE OS maintains a partnership with the Aquarium through its support of the New England Ocean Science Education Collaborative (NEOSEC). NEOSEC's Principal Investigator is Billy

Spitzer, Vice President of Programs, Exhibits and Planning at NEAq. He is now also serving as COSEE OS Associate Director under the Center's renewed National Science Foundation grant. Also involved in this partnership are Catherine Cramer, Communication & Outreach Coordinator for NEAq and Communication Coordinator for NEOSEC, and Pam DiBona, NEAq Project Manager and Program Coordinator for NEOSEC.

Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS)
NERACOOS is a nonprofit organization with a mission to advocate for ocean observing systems through education and outreach. Under the leadership of Executive Director Dr. Ru Morrison they have partnered with COSEE OS on science advising and staff have participated in Center workshops and meetings. COSEE OS will help NERACOOS and NEOSEC collaborate on developing and implementing joint communication strategies for disseminating the importance of ocean observing to research and development partners, ocean literacy groups, and decision makers.

Raytheon Web Solutions
As a subawardee with the University of Maine, Program Manager David Overoye's team has partnered with COSEE OS in the development of the Center's multimedia software.

Repa & Associates
Since 2008, Dr. Ted Repa, President of Repa & Associates, has served as External Evaluator to COSEE OS and provides guidance and oversight in all related matters.

Seacoast Science Center
Seacoast Science Center (SSC) is a non-profit organization on the NH coast that reaches approximately 6,000 visitors a year and runs a variety of marine science programs for the general public, school groups, and educators. Their state-of-the-art distance-learning center allows connections with scientists in labs, school groups across the country, as well as interactive programs to teach a wide variety of topics related to marine science. Under the coordination of Wendy Lull (President) and Steven Engstrom (Senior Aquarist), their partnership with COSEE OS and the University of New Hampshire seeks to expand the capacity of those organizations by sponsoring part-time "Broader Impacts Liaison" positions at each institution.

Sea Grant Extension – Maine Sea Grant
Maine Sea Grant, based at the University of Maine (UMaine), supports marine and coastal scientific research and education. Associate Extension Professor, Esperanza Stancioff, in partnership with UMaine Cooperative Extension, is focusing on issues of concern to coastal communities, and ways to extend current knowledge and expertise to stakeholders.

Sea Grant Extension – Oregon Sea Grant
Oregon Sea Grant, based at Oregon State University, supports an integrated program of research, education and outreach to help people understand and conserve ocean and coastal resources and is partnered with COSEE-Pacific Partnerships (PP). COSEE OS and COSEE-PP work together

to test the theory that understanding and addressing stakeholders' existing mental models is a first key step to educating about climate change issues. This activity will be grounded in existing research conducted by Dr. Shawn Rowe, Asst. Professor and Marine Education Learning Specialist at COSEE-PP and Oregon Sea Grant, on the application of statistical and analytical tools to assess online concept maps.

U.S. Geological Survey, Augusta, ME
Research Hydrologist Tom Huntington assisted in COSEE OS's early educational resource review process that enlisted teams including a scientist, a classroom teacher, and an informal educator. Teachers were asked to describe what they look for when they are searching for lesson activities. The important elements the teachers focused on included cost, safety / age appropriateness, ease of implementation, and availability of solid background knowledge.

University of Connecticut, Sea Grant Extension
Diana Payne is the Education Coordinator for Connecticut Sea Grant and an Assistant Professor in Residence at the University of Connecticut's Neag School of Education. She coordinated Sea Grant's co-sponsorship of the COSEE OS Scientist-Educator Collaborative Workshop at the University of Connecticut, Avery Point.

University of Maine
The University of Maine is the sponsoring institution for COSEE-Ocean Systems (OS). Many fruitful relationships have resulted from this partnership. In addition to the facilities, staff and other resources available, there have been productive collaborations with graduate students and faculty in the School of Marine Sciences (e.g., Professor Lee Karp-Boss, Mary Jane Perry and Annette deCharon for workshop and course instruction;); the College of Education and Human Development (Professor Emeritus Herman Weller, workshop and course instruction); the Center for Research & Evaluation (Director Walter Harris, external evaluation of COSEE OS); and Sea Grant Extension (Director Paul Anderson, advisory support). UMaine Associate Professor, Sara Lindsay, is named as a co-PI in the COSEE OS renewal grant. Dr. Lindsay previously oversaw a master's project in which commonly held misconceptions were identified and methods were designed to improve SMS undergraduate education. She will expand on this work by identifying new student-learning outcomes that will be mapped to the undergraduate curriculum by School of Marine Sciences faculty.

University of New Hampshire
Since its inception, COSEE OS has had a partnership with the University of New Hampshire. UNH scientists have participated in COSEE OS workshops, and have collaborated in evaluation, workshop co-facilitation and course instruction. Specific partners have included members of the Institute for the Study of Earth, Oceans and Space (Research Professor, Janet Campbell); the Department of Education (Associate Professor of Education, Eleanor Abrams); and Sea Grant Extension (Director, Jonathan Pennock). Currently, Mark Wiley, who serves as Extension Associate Professor and Marine Science Education Specialist for the Cooperative Extension program is collaborating with COSEE OS in broader impacts liaison for UNH and exploring broader impacts strategies beyond UNH.

University of Southern Maine
Jeffrey Beaudry is Associate Professor in Educational Leadership at the University of Southern Maine. As a user of concept mapping he was interested in other strategies and approaches for applying the tool. He attended COSEE OS scientist-educator collaborative workshops at the Seacoast Science Center and the University of New Hampshire as an observer in order to learn and provide input on the processes used.

University of Southern Mississippi
Drs. Karen Orcutt (Assistant Professor) and Kjell Gundersen (Assistant Research Professor) have partnered with COSEE OS since 2009 when they presented concept maps in a session at the National Science Teachers Association Conference in New Orleans. They updated those maps and have since presented in two COSEE OS webinars. As a result, they have embraced concept mapping as a tool in their teaching and advising.

COSEE Alaska

The Alaska Center for Climate Assessment and Policy (ACCAP)
The mission of ACCAP is to assess the socio-economic and biophysical impacts of climate variability in Alaska, make this information available to local and regional decision-makers, and improve the ability of Alaskans to adapt to a changing climate. Based in Fairbanks with close affiliations with UAF, ACCAP was established in 2006 with core funding from the Climate Program Office of NOAA and is one of a group of Regional Integrated Sciences and Assessments (RISA) programs nation-wide. ACCAP partners with COSEE Alaska in their approach of promoting continuing feedback between information users and scientists. COSEE Alaska features their monthly webinar series with Alaska climate change scientists when the topic is relevant to Alaska ocean climate change on the SEANET blog and as links to archived resources. COSEE Alaska collaborated with ACCAP to create a web page on the COSEE Alaska website on the topic of ocean acidification in Alaska and other high-latitude waters, and other topical resource pages (e.g., melting sea ice) on specific Alaska ocean climate change topics are planned.

The Alaska Ocean Observing System (AOOS)
AOOS is a partner in the COSEE Alaska project and the regional ocean observing program. AOOS, Alaska Sea Grant, and COSEE Alaska staff collaborated to design and facilitate science outreach using the AOOS Prince William Sound Field Experiment during July and August 2009. The project involved more than a dozen scientists from the University of Alaska, Prince William Sound Science Center and Oil Spill Recovery Institute, NASA's Jet Propulsion Lab, and four universities in California, Maine, and Texas and field tested AOOS models for wind, waves, weather, and ocean circulation. COSEE Alaska staff assisted the other partners in the use of both standard and innovative outreach strategies based on a theme of "Sound Predictions 2009." News about the experiment was provided online and through press releases, newsletters, brochures, and newspaper inserts distributed free to ferry and cruise ship passengers. In addition, community gatherings were held in Valdez and Cordova, Alaska. Web blog entries and photos were posted daily, and a NASA Jet Propulsion Lab data portal provided opportunities for interactive comparisons of the predicted and actual drifter trajectories. AOOS also co-sponsors workshops with COSEE Alaska at the Alaska Marine Science Symposium.

Arctic Research Consortium of the United States (ARCUS)
ARCUS, based in Fairbanks, Alaska, was formed in 1988 as a nonprofit member consortium of educational and scientific institutions that have a substantial commitment to arctic research. ARCUS facilitates discussion of important arctic research initiatives, produces science reports with research community recommendations for arctic science priorities, and distributes information resources to the arctic research community. ARCUS activities are funded through member dues and contracts and grants with federal and private entities. ARCUS is a non-profit corporation consisting of institutions organized and operated for educational, professional, or scientific purposes. The ARCUS educational staff share their access to networks of Arctic scientists interested in education and outreach and educators interested in polar education with

COSEE Alaska. They also collaborated with COSEE Alaska to involve teachers with research experience through their NSF-funded PolarTREC program and researchers in the Bering Sea in the Bering Sea Scientist-Teacher Professional Development Workshop in October, 2010. The Bering lesson plans and collection of K-12 educational resources that were a product of the workshop will be housed on their website with other collections of educational resources related to polar education. ARCUS also co-hosted a Polar Teacher Conference as part of the International Polar Year Science Conference in Oslo, Norway, in June, 2010, and provided travel support to COSEE Alaska Program Manager Marilyn Sigman to participate and present a poster.

The International Arctic Research Center (IARC)
IARC, located at the University of Alaska Fairbanks (UAF), focuses on understanding the Arctic as a system and reducing uncertainty in Arctic climate change predictability. IARC was established in 1999 as a cooperative research institute supported by both the U.S. and Japanese governments. Funding comes from the National Science Foundation and the National Oceanic and Atmospheric Administration in the U.S. and from the Japan Agency for Marine-Earth Science and Technology, and Japan Aerospace Exploration Agency. More than 20 international groups and more than 60 scientists are collaborating with IARC, allowing the institute to meet our mission and goals through shared understanding and cooperation. IARC shares educator and scientist networks with COSEE Alaska and collaborated in the design and distribution of an online needs assessment survey to K-12 classroom teachers to discover what climate change topics are being addressed by educators and what needs exist for marine science and climate change education curriculum, resources and professional development. IARC staff have served on a COSEE Alaska-led team to develop a K-12 curriculum framework for teaching the relevant concepts relevant to Alaska marine and polar environments and provided an interactive scientist presentation at the 2009 Salmon-in-the-Classroom rural teacher professional development workshop.

The North Pacific Research Board (NPRB)
NPRB is an organization that supports wide-ranging marine research in an effort to achieve its overall mission of building a clear understanding of the North Pacific, Bering Sea, and Arctic Ocean ecosystems that enables effective management and sustainable use of marine resources. It emphasizes research that best addresses pressing fishery management or marine ecosystem needs. Beginning in 2007, NPRB began to design and fund a series of integrated ecosystem programs, the first of which focused on the Bering Sea/Aleutians Large Marine Ecosystem (LME), and leveraged the efforts of an on-going NSF-funded Bering Ecosystem Study (BEST) project with the NPRB-funded Bering Sea Integrated Ecosystem Research Project (BSIERP). This $52 million study involves more than 100 scientists who are one of the target audiences for COSEE Alaska activities that provide tools and opportunities to improve communication, outreach, and education skills. NPRB has a strong commitment to excellent education and outreach to disseminate research results to the public. COSEE Alaska offices are co-located with NPRB in Anchorage, Alaska and the two programs share the skills of Nora Deans, who is both the NPRB Communication and Outreach Director and the COSEE Alaska Project Director. This has resulted in the transfer of excellent education and outreach strategies as well as collaborations such as the Bering Sea Scientist-Teacher Professional Development Workshop in

October, 2010, which produced lesson plans and a collection of K-12 educational resources based on current BEST/BSIERP science. A collaborative oral presentation about this successful outreach and education project has been accepted for the 2011 Alaska Marine Science Symposium. Additional collaborations are planned for the Gulf of Alaska and Arctic Ocean LME projects during the life of the COSEE Alaska project. COSEE Alaska participates in planning for the Alaska Marine Science Symposium under NPRB's leadership and co-sponsors COSEE Alaska workshops held during the Symposium.

The Prince William Sound Science Center (PWSSC)
PWSSC is a non-profit research and education organization located in Cordova that facilitates and encourages ecosystem studies in the Greater Prince William Sound region, Alaska. PWSSC scientist were involved in research during the AOOS Prince William Sound Research Center and COSEE Alaska worked with them to design and provide education and outreach about the experiment. Following the field experiment, COSEE Alaska partnered with the PWSSC education staff to develop middle school lesson plans to teach science concepts illustrated by the field experiment and employing Alaska ocean observing data. COSEE Program Manager Marilyn Sigman is also an advisor to PWSSC's "Headwaters to Ocean" (H20) watershed and ocean curriculum development project that will feature state-of-the-art data visualization and access and use of real-time data in K-12 classrooms.

UAF Cooperative Extension Service
Cooperative Extension's 4-H Fisheries, Natural Resource and Youth Development Program is designed to train village youth in science and math skills through fishery biology and hands-on learning. This far-reaching and long-term educational and community effort has been supported by state agencies, schools, and residents of many Alaska villages for 30 years. The centerpiece of the educational strategy is a classroom incubation of salmon which provides extended opportunities for inquiry-based science and extensions of learning about the salmon life cycle, ecology, and economic and cultural importance to rural Alaska. COSEE Alaska partnered with Cooperative Extension and the U.S. Fish and Wildlife Service in 2009 and 2010 to provide ocean climate change science content and engage scientists in an annual professional development workshop for 20 rural Alaskan teachers who work in schools whose students are predominantly Alaska Native.

COSEE Pacific Partnerships

University of Oregon Institute of Marine Biology (OIMB)
OIMB, located in Charleston, Oregon at the mouth of Coos Bay, provides opportunities for graduates and undergraduates and supports the marine biology major program of the Department of Biology. OIMB provides access to diverse marine habitats of the Oregon coast, has modern facilities for research, and housing and dining facilities for students, researchers and visiting faculty and groups. OIMB is one of the primary marine laboratories involved in COSEE-PP. PI Hodder is OIMB faculty and Coordinator Gehrke is based at OIMB. In addition to providing facilities and resources for COSEE-PP activities, OIMB scientists have been an integral part in the development and implementation of the Center's programs. They have served as mentors for COSEE-PP's community college student research internship program, instructors for community college professional development workshops, and they have developed and piloted instructional units for the Coastal Master Naturalist Program, a training certification program for volunteers.

Oregon State University Hatfield Marine Science Center (HMSC)
HSMC, located on a 49-acre site on Yaquina Bay in Newport, Oregon, includes OSU researchers, students, and faculty from five colleges and more than ten departments, and serves as home to several University research programs. HMSC onsite partners include seven state and federal agency activities involved in research and management of the marine environment, and they work closely with the local communities and the HMSC Visitor Center is a key site for public education. HMSC is one of the primary marine laboratories involved in COSEE-PP. Co-Director Rowe is located at HMSC and Co-PI Boehlert is HMSC Director. In addition to providing facilities and resources for COSEE-PP activities, HMSC and OSU scientists have been an integral part in the development and implementation of the Center's programs. They have served as mentors for COSEE-PP's community college student research internship program and instructors for community college professional development workshops.

Western Washington University Shannon Point Marine Center (SPMC)
SPMC implements academic programs in marine science that promote a better understanding of the environments and living resources of the Puget Sound basin through research by students and scientists and via innovative education programs. Since its inception in 1973, SPMC has collaborated with local community colleges belonging to a consortium that utilize the facilities of the marine center. SPMC also has worked informally with the Padilla Bay National Estuarine Research Reserve (PBNERR). Dr. Jude Apple, SPMC Marine Scientist & Public Education Specialist, is coordinating COSEE-PP activities in Washington. Through COSEE-PP programs, SPMC is strengthening and formalizing relationships with local community colleges and PBNERR. SPMC is one of the primary marine laboratories involved with COSEE-PP. Beginning in 2009, SPMC scientists have served as mentors for COSEE-PP's community college student research internship program and as instructors for community college professional development workshops. Planning is currently underway to begin offering the COSIA course at WWU and for a multi-day COSIA-based workshop that would connect SPMC

scientists with PBNERR staff and other informal educators in the region. Apple has strong connections with the Northwest Indian College and is working towards engaging them in COSEE-PP activities.

Humboldt State University Marine Laboratory (HSUML)
HSUML opened in 1965 and was established to provide a center for marine and environmental science teaching and research for undergraduate and graduate students and faculty of the College of Natural Resources and Sciences at HSU. Located on a bluff that overlooks the Pacific Ocean in Trinidad, California, HSUML provides ready access to the local marine environments of rocky shorelines, sandy beach and offshore kelp beds and is well equipped to support both teaching and research projects on the marine life and the ocean environments and has an on-going outreach function supported through its marine naturalist program and a small public display aquarium. HSUML is one of the primary marine laboratories involved with COSEE-PP. In the past, HSUML has supported informal educational experiences with the staff of the HSU Natural History Museum and other informal science education institutions in the region and with COSEE-PP program support, HSUML is working to strengthen and formalize these relationships. HSUML scientist Dr. Sean Craig is coordinating COSEE-PP activities at HSU to connect marine scientists with informal educators.

University of Hawaii at Mānoa Kewalo Marine Laboratory (KML)
KML's mission is to support the investigation of fundamental questions in biology using the rich diversity of animals, plants and microorganisms present in the Hawaiian near-shore marine environment. KML is active in graduate, undergraduate and postdoctoral training and with a research emphasis on molecular, cellular, developmental and evolutionary biology. KML is one of the primary marine laboratories involved with COSEE-PP. KML has several strong partnerships with community colleges several of which are supported with NSF funding through NSF URM, ATE, and Research Opportunities awards. Dr. Mike Hadfield, KML faculty, and Dr. Gail Grabowski, Director of the Environmental Studies Program at Chaminade University, are coordinating COSEE-PP activities at KML that will build upon these existing relationships. Beginning in summer 2010, KML scientists served as mentors for COSEE-PP's community college student research internship program and Hadfield and Grabowski began working with Hawaiian and Micronesian community colleges to plan activities for community college faculty professional development. In addition, planning is currently underway to begin offering multi-day COSIA-based workshops that would connect scientists with informal marine science educators, particularly ecotour operators on O□ahu.

South Slough National Estuarine Research Reserve (SSNERR)
SSNERR is a 4,800 acre natural area located in the Coos estuary on the south coast of Oregon. The Reserve was designated in 1974 at the first unit of the National Estuarine Research Reserve System (NERRS), a network of estuarine habitats protected and managed for the purposes of long-term research, education, and coastal stewardship. Beginning in 2008, SSNERR scientists and educators served as mentors for COSEE-PP's community college student research internship program and they have developed and piloted an instructional unit on estuaries for the Coastal Master Naturalist Program, a training certification program for volunteers.

Padilla Bay National Estuarine Research Reserve (PDNERR)
PDNERR, located in Skagit County, Washington, in the northern reaches of greater Puget Sound, on the southeastern fringe of the San Juan Archipelago, covers more than 14,000 acres of a broad, flat intertidal embayment disconnected from normal flows of the Skagit River due to diking and protects one of the largest continuous beds of eelgrass in the contiguous United States. Through COSEE-PP programs, PDNERR is strengthening and formalizing relationships with the Shannon Point Marine Center, one of the primary marine laboratories involved with COSEE-PP. In 2010, PDNERR scientists and educators served as instructors for a day of the community college professional development workshop at SPMC. Planning is currently underway for a multi-day COSIA-based workshop that would connect scientists and educators at PBNERR and SPMC as well as other informal educators in the region.

Northwest Association of Networked Ocean Observing Systems (NANOOS)
NANOOS is the Regional Association of the national Integrated Ocean Observing System (IOOS) in the Pacific Northwest, primarily Washington and Oregon. NANOOS has strong ties with the observing programs in Alaska and British Columbia through their common purpose and the occasional overlap of data and products. NANOOS is a partnership of over 30 entities, including industry, state agencies, local governments, tribes, non government organizations, and educational institutions. COSEE-PP's partnership began when Coordinator Gehrke, as a representative of COSEE-PP, joined the NANOOS Education and Outreach subcommittee in 2008. Since then, NANOOS scientists and educators have developed materials and provided instruction for several of COSEE-PP's professional development activities for community college faculty. In March 2010, COSEE-PP Director Jan Hodder wrote a letter of support for the NANOOS proposal "Fostering citizen science participation in ocean observing in the Pacific NW" to NOAA's Environmental Literacy program committing COSEE-PP to assisting NANOOS develop learning modules focused on ocean dynamics along the Oregon and Washington coast that would support partnerships between ocean scientists and volunteer groups who conduct citizen science projects.

The Center for Coastal Margin Observation & Predication
The Center for Coastal Margin Observation & Prediction (CMOP), a large multi-institutional partnership with Oregon Health & Science University, Oregon State University, and University of Washington as the anchor partners, is an NSF Science and Technology Center (STC) focused on coastal margins and ocean issues. Since 2008, CMOP and COSEE-PP have collaborated on several program and activities for scientists, community college faculty and informal educators. During 2008, CMOP staff served on the curriculum working group of the COSEE-PP Coastal Master Naturalist Program. In April 2009, COSEE-PP staff ran a communications workshop for CMOP scientists. In 2010, COSEE-PP sponsored a CMOP scientist to present a special session for community college faculty at the annual meeting of the Oregon Academy of Science.

Oregon Coast Aquarium (OCAQ)
OCAQ is a private, not-for-profit aquatic and marine science educational facility offering a fun and interesting way to learn about Oregon's unique coastal ecosystem. The Aquarium is

dedicated to teaching marine wildlife and ocean preservation through responsible management and exhibition of marine life. COSEE-PP Co-PI Kerry Carlin Morgan is the OCAQ Director of Public Program. OCAQ has been involved in COSEE-PP efforts to develop a range of model professional development opportunities in communicating ocean sciences for educators, other staff, and volunteers at informal science education institutions, including an evaluation of the redesign of their volunteer training program using principles of reformed science teaching, inquiry, and interpretation and the development of the Coastal Master Naturalist Program curriculum. In addition, OCAQ has provided facilities, resources, and staff to support summer community college student interns.

Association of Zoos and Aquariums Board of Regents (AZA)
COSEE-PP has an ongoing, substantive relationship with AZA to create professional development in communicating ocean sciences for AZA educators and husbandry staff. In 2009, COSEE-PP worked with AZA to conduct a needs assessment with both education and husbandry staff at AZA member institutions designed to document the level of support for, interest in, and needs surrounding on-going professional development or certification in communicating ocean sciences. COSEE-PP & AZA are currently outlining potential curriculum and materials COSEE-PP can offer through their online, national training. Cynthia Vernon, the chair of the board of regents and Vice President of Education, Guest, and Research Programs at the Monterey Bay Aquarium, has served on the COSEE-PP advisory committee since 2009.

Oregon Master Naturalist Program (OMNP)
The OMNP is an adult education program administered by Oregon State University Forestry and Natural Resources Extension. The goal of the program is to educate citizens about a broad range of Oregon's natural resources through classroom instruction and hands-on field experiences. In return for their education, participants give back an equal amount of time in service to natural resource agencies and nonprofits within their local area. The OMNP is being developed around five bioregions, the coast being one of them. Beginning in 2008, COSEE-PP took the lead in a partnership with regional volunteer-based organizations to support the development of the Oregon Coast Ecoregion (CMNP). The COSEE-PP led curriculum working group developed a modular curriculum and implementation plan for the CMNP and worked closely with the state coordinator of the OMNP to integrate the coastal and state elements of the program. Piloting of the COSEE-PP CMNP curriculum units began in March 2010 and will continue through spring 2011 at which point the OMNP will take over the coastal program.

Northwest Biology Instructors Organization (NWBIO)
NWBIO began in 1966 as a way to facilitate dialogue between faculty of Washington State community colleges, universities, and private four-year colleges, on pedagogical and scientific problems in the field of biology. Originally called WACBT (Washington Association of College Biology Teachers), NWBIO now includes additional faculty from British Columbia, Oregon, and Northern Idaho and is primarily attended by community college faculty in the biological sciences.
We learnt of NWBIO while conducting a needs assessment with Oregon community college faculty. In 2008, COSEE-PP arranged for an OIMB scientists to be a keynote speaker at the meeting and gave a presentation about the Center's opportunities for community college faculty

and students. During the presentation faculty were asked to suggest marine topics/themes they would be of use to their teaching for the summer professional development workshops. Based on what was learnt during the first meeting, COSEE-PP PI Hodder and Coordinator Gehrke worked with the organizers for NWBIO to plan professional development workshops for community college faculty offered in conjunction with the 2009, 2010, and 2011 meetings.

COSEE Ocean Systems

At the 2010 Ocean Sciences Meeting, COSEE-PP and COSEE-OS staff began discussing the possibility of running COSEE-OS's Scientists-Educator Collaborative (SEC) workshop somewhere on the west coast. Over a series of conferences calls, COSEE-PP, COSEE-OS, and COSIEN staff developed a three-day SEC-based workshop for ocean scientists from California Polytechnic State University, San Luis Obispo, and informal educators from the central California coast. COSEE-OS staff traveled to Cal Poly to help COSEE-PP staff learn to use the techniques and online tools developed by OS and to co-facilitate the workshop. Based its success, COSEE-PP is planning to use the structure and tools of this workshop to hold similar workshops in Oregon and Washington in 2010 and 2011. Also as result of this collaboration, COSEE-PP provided a letter of support for the COSEE-OS grant renewal proposal to investigate how stakeholders' and scientists' existing mental and conceptual models about climate change issues can be articulated and shared as part of better decision-making. COSEE-PP will help develop and "field test" some of the techniques and tools that the OS/PP/OSGE partnership will develop with their audiences: ocean scientists, informal educators, and community college instructors.

COSIA Educators Network (COSIEN)

In April 2010, through COSEE-PP Co-PI Shawn Rowe's involvement with both grants, COSEE-PP and COSEIN staff began planning for a series of co-sponsored workshops to be offered in 2010 and 2011 that would foster ongoing collaboration between scientists and informal educators. In May 2010, COSEE-PP and COSIEN, in partnership with COSEE-OS (detailed below), brought together scientists and informal educators from the central California coastal region for a three-day collaborative concept mapping workshop at California Polytechnic State University. The second workshop, held in October 2010 at Humboldt State University, brought together graduate students and informal educators from the northern California Coast for three days of COSIA-based curriculum and activities. Planning is currently underway to offer two more collaborative COSIA-based workshops at COSEE-PP partner marine stations in Washington and Hawai'i.

Oregon Sea Grant (OSG)

OSG, based at Oregon State University, has been involved in many COSEE-PP activities. OSG scientists, extension agents, staff, graduate students, and educators have served as mentors for COSEE-PP community college student interns in the Promoting Research Investigations in the Marine Environment (PRIME) program, assisted with the organization and implementation of COSEE-PP sponsored communications and workshops for scientists, served on the curriculum working group for the Coastal Master Naturalist volunteer training program and are involved in

the ongoing development, piloting, and evaluation of several CMNP units. Based on lessons learned from PRIME, COSEE-PP staff provided advice to OSG on the development of their Summer Scholars Program. Co-PI Rowe is an OSG Extension Marine Education Learning Specialist and leads research and evaluation at OSU's HMSC Visitor Center, which is operated by OSG.

Oregon Academy of Science (OAS)
The OAS is an affiliate of the American Association for the Advancement of Science (AAAS). The AAS is funded by its member academies with the purpose of keeping members informed of each other's activities, and to promote university and pre-college scientific organizations that encourage interest in the sciences, math, and engineering and the OAS promotes scientific research and education in Oregon. In 2009, COSEE-PP began working with the chair of the OAS Education Division to organize a special session for community college faculty at the 2010 OAS annual meeting. COSEE-PP Advisory Committee member Dieterich Steinmetz, Interim Division Dean of Science and Engineering at Portland Community College's Sylvania Campus, was named the President of OAS at the 2010 meeting. Steinmetz is working with COSEE-PP to plan a poster session for community college student interns and a special session for community college faculty during the 2011 meeting.

Northwest Center for Sustainable Resources (NCSR)
NCSR, an NSF-ATE funded center, is a national collaborative of partners from education, business and industry, American-Indian tribes, and government agencies, focused on creating, disseminating, and supporting adaptation of natural resource college-level curriculum materials. The needs assessment COSEE-PP conducted with community college faculty indicated that the NCSR professional development activities were well designed and the workshops and products developed by the NCSR for their institutes were very useful. COSEE-PP consulted with the PI of NCSR about their and determined they provided a good model for COSEE-PP community college faculty professional development workshops. NCSR helped advertise COSEE-PP's summer 2010 oceanography workshop and COSEE-PP assisted NCSR PIs with contacting scientists to make presentation to the community college faculty who attended their institute on fisheries science in 2009. PI Hodder has written two articles for the NCSR newsletter and serves on the Center's National Advisory Board.

Northwest Aquatic and Marine Educators (NAME)
NAME is a chapter of the National Marine Educators Association serving Alaska, British Columbia, Washington and Oregon. NAME encourages professional growth by offering quality workshops, conferences, field experiences, and in-services in the Pacific Northwest, shares information and education materials focused on marine and aquatic environments and issues and, promotes the magic of water as a catalyst for learning. In 2009, COSEE-PP Coordinator Gehrke served on the annual NAME conference planning committee. COSEE-PP sponsored two ocean scientists to be key note speakers and offered a pilot unit of the Coastal Master Naturalist volunteer training program in conjunction with the conference in an effort to help increase the number of volunteer docents involved with NAME.

Science and Math Investigative Learning Experience (SMILE) Program
SMILE is a partnership between Oregon State University and 14 Oregon school districts to provide science and math enrichment for underrepresented and other educationally underserved students in grades 4-12. The areas served by SMILE after school clubs are poor, largely rural, and educationally under-served with significant numbers of American Indian and Hispanic students. Partnerships and grants provide program funding, content support in science and math, and teacher professional development and club materials focused on ocean sciences. COSEE-PP worked with SMILE staff to adapt the three-day COSEE-OS Scientist-Educator Collaborative (SEC) concept mapping workshop for SMILE club teacher professional development activities with ocean science engineers in 2011.

Oregon Shores Conservation Coalition
Oregon Shores is dedicated to preserving the natural communities, ecosystems and landscapes of the Oregon coast while conserving the public's access. Oregon Shores pursues these ends through education, advocacy, and engaging citizens to keep watch over and defend the Oregon coast. Shores members are a key target audience for the COSEE-PP Coastal Master Naturalist Program (CMNP), a program designed to educate citizens about a broad range of Oregon's natural resources through classroom instruction and hands-on field experiences. Oregon Shores members and staff contributed to the development of the CMNP and the Director served on the CMNP curriculum working group. The pilot of the introductory CMNP unit was offered in conjunction with Oregon Shores annual meeting. As the CMNP continues to develop, COSEE-PP and Oregon Shore continue to explore ways in which to mutually support their efforts.

Shoreline Education for Awareness (SEA)
SEA provides trained docents to visitors, schools and civic groups in meeting its primary mission of education regarding shoreline habitats and the wildlife along the southern Oregon coast. SEA docents are a key target audience for the Coastal Master Naturalist Program (CMNP). Each winter and spring, SEA recruits marine scientists to lead their docent training seminars. COSEE-PP is working with SEA to help them recruit scientists and to adapt their existing training seminars into CMNP curriculum units to be piloted during winter 2011.

COSEE Coastal Trends

K-12 formal education partnerships

Queen Anne's County Public Schools

Developed ocean science curriculum for incoming 9th grade students for entire county.

Dorchester County Public Schools

Provided student field activities for all 7th grade students in the county based on our Seagrass Module, for all science fair participants and all STEM students based on our Observing the Ocean Module.

Talbot County Public Schools

Provided student field activities for all 8th grade students in the county based on our Marine Bacteria module.

Research Institutions

University of Maryland Center for Environmental Science, Horn Point Laboratory

Home of Director of COSEE Coastal Trends. Scientists hosted our Dead Zones, Fish and Physics, From Land to Sea Scientist-Educator Partnerships.

University of Maryland Center for Environmental Science, Integration Application Network.

Hosts our co-PI, Science Communicator and internal evaluator.

Hampton University.

Hosts our co-PI, Deidre Gibson, and provides the underrepresented undergraduate student for the Scientists-Educator Partnership.

Anheuser Bush Coastal Research Center, VA LTER

Hosted our Seagrass Scientist-Educator Partnership.

University of Delaware Institute of Coastal and Marine Science

Hosted our Marine Bacteria Scientist-Educator Partnership.

Virginia Aquarium and Marine Science Center.

Hosts our Co-PI, Chris Witherspoon, and the COSIA course and the Mentoring Young Scientists programs.

Maryland State Department of Education.

Helped with the Queen Anne's County Ocean Science course and teacher recruitment for our institutes and the Scientist-Educator Partnership program.

College of Exploration

Bishop and Walters served as our external evaluators

COSEE Networked Ocean World

Integrated Ocean Observing System (IOOS)
The Integrated Ocean Observing System (IOOS®) is a federal, regional, and private-sector partnership working to enhance the publics' ability to collect, deliver, and use ocean information. IOOS delivers the data and information needed to increase understanding of our oceans and coasts, so decision makers can take action to improve safety, enhance the economy, and protect the environment. COSEE NOW partners with a broad range of scientists and educators from each of the eleven regional centers. Joint projects have included participation in a major storytelling workshop (2009), drafting of a NOAA Environmental Literacy proposal, two joint national conference presentations, and two peer reviewed publications.

COSEE NOW works closely with the **Mid Atlantic Regional Association (MACOORA)** closely to assist with education and public outreach initiatives with the MACOORA membership including but not limited to Monmouth University, Maryland Sea Grant, and Stevens Institute of Technology.

COSEE NOW is an integral member of the MARACOOS project. **MARACOOS, the Mid-Atlantic Regional Association for Coastal Ocean Observing Systems**, is a partnership of Universities, private companies, non-governmental institutions and state/federal government agencies that coordinates and facilitates observations of the ocean and estuaries between Cape Hatteras and Cape Cod. MARACOOS leverages an integrated system of scientific data from satellites, buoys, ocean radar, underwater gliders and other technologies to support real world needs. COSEE NOW works with MARACOOS membership on website usability on data products.

Ocean Observing Initiative (OOI)
The Ocean Observatories Initiative (OOI) is an NSF funded initiative designed to construct a networked infrastructure of science-driven sensor systems to measure the physical, chemical, geological and biological variables in the ocean and seafloor. Greater knowledge of these variables is vital for improved detection and forecasting of environmental changes and their effects on biodiversity, coastal ecosystems and climate. COSEE NOW partners with each of the implementing organizations (IOs) on a variety of levels including soliciting needs of scientists and facilitating presentations at meetings.

4 –H Youth Development
The 4-H Youth Development programs serves 6 million children ages 8-18 in 3,150 counties across the United States including at-risk youth with a history of strengthening essential life skills. COSEE NOW works at both the state and national level to explore partnering opportunities with scientists and young people in after and in-school settings. Outcomes include drafting five NSF and NASA proposals (one of which was funded) and the creation of four new science education programs.

The Coalition for Science After School (CSAS)
CSAS is a strategic alliance of individuals and organizations from STEM education, youth development, and after school programs. CSAS represents organizations from across the country committed to quality STEM learning opportunities available in out-of-school time cultivating, coordinating, and mobilizing community stakeholders to strengthen and expand opportunities for young people to learn science beyond the classroom.

The Climate Literacy Network (CLN)
CLN provides a forum for organizations, agencies and individuals to collaborate for climate education. CLN initiatives feature accurate scientific information, engaging learning experiences, and multiple pathways to reach broad and diverse audiences, in both formal and informal venues. CLN and COSEE NOW have collaborated on writing proposals and have had numerous meetings to promote climate literacy and plan future joint programs.

University of Maryland
University of Maryland Center for Environmental Studies (UMCES), the Horn Point Laboratory (HPL), and the Chesapeake Biological Laboratory were partners in the COSEE Mid Atlantic (COSEE MA) from 2002-2006. Approximately ten scientists from these institutions participated in the production of a COSEE MA curriculum series called *Taking the Pulse of Our Changing Planet*, focused on the use of real time data in 6-12 classrooms.

Virginia Institute of Marine Science (VIMS)
Facilitated by VIMS, the Eastern Shore Soil and Water Conservation District Environmental Education Program and the Eastern Shore Environmental Education Council partnered with COSEE MA to assist with teacher professional development recruitment and support of teachers working with underserved and underrepresented youth. More recently with COSEE NOW, we have expanded our VIMS partnerships with Virginia Sea Grant.

Hampton University
Drs. Ben Cuker and Deidre Gibson assisted COSEE MA with the identification of minority graduate student candidates for project involvement, and coordinate minority involvement in project activities. In addition, Deidre lead the COSEE MA in partnerships with leading experts from Penn State and McGill University in cultural competency to provide comprehensive training for twenty five scientists.

U.S. Coast Guard
Lieutenants S. Marshall Griffin, Daniel J. Twomey, Scott Rae, commanders of U.S. Coast Guard vessels, have collaborated with Liberty Science Center in providing on-ship experiences for students and teachers to explore the Hudson River Estuary. Liberty Science Center staff led COSEE-NOW developed activities and the Coast Guard personnel explain the ship and Coast Guard operations to give students and teachers experience and knowledge with use of the New York/New Jersey Bay system as both a natural system and as one heavily used by humans for economic and recreational activities

Meadowlands Environmental Center (MEC),
Dr. Angela Cristini and her staff collaborated with Liberty Science Center (LSC) in incorporating our COSEE-NOW developed Salt Wedge lesson into their programs and in creating lessons for MEC summer campers for exploration of the differences between the Hackensack River, where the MEC is located, and the Hudson River, upon which LSC is located.

COSEE CA, COSEE OS, COSEE CGOM, COSEE OCEAN, and COSEE GL
Although COSEE NOW works closely with all centers, we have joint grants and formal projects with COSEE CA, CGOM, OCEAN, and OS.

COSEE Central Coordinating Office

The CCO is creating relationships with the following programs and professional societies to strengthen the reach of the COSEE Network:

- American Meteorological Society
  - Partnering in conference booth space
  - Partnering on future proposals
  - In discussions to cross promote educational materials
  - Drafting a Memorandum of Understanding between organizations
- Marine Technology Society
  - Exploring the development of a set of hands-on ocean technology activities for the high school classroom
- Inner Space Center
  - Partnering in a prototype project to develop infrastructure, hardware, and software to deliver live and preprogrammed feeds from the U.S. research fleet to aquariums
- Marine Advanced Technology Education Center
  - Partnering in conference booth space
- American Society of Limnology and Oceanography
  - Partnering with the Multicultural Program to offer Young Investigators workshops
  - Partnering to offer ASLO Student Chapters educational activities for outreach activities
  - Drafting a Memorandum of Understanding between organizations
- Innovative Technology Experiences for Students and Teachers (ITEST) Network Learning Resource Center
  - Partnered in conference booth space
  - In discussions to partner in future proposals
  - Webinar featuring ITEST and COSEE developed curricula
- The Ocean Project
  - Partnering in future proposals
  - Open to future collaborations
- National Environmental Education Foundation
  - Developed messages with the COSEE Messaging and Marketing Committee for use in the Smithsonian's Sant Ocean Hall
  - Creating Teacher Toolkits to support NEEF's 2011 Environmental Education Week – theme Ocean Connections
  - Providing content for NEEF's Classroom Earth program
  - Providing content for NEEF's Planet Connect program